ASSEMENT OF WORKERS SAFETY PRACTICE IN PUBLIC BUILDING CONSTRUCTION PROJECTS:

IN THE CASE OF ADDIS ABABA CONSTRUCTION OFFICE PROJECTS

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ASSEMENT OF WORKERS SAFETY PRACTICE IN PUBLIC BUILDING CONSTRUCTION PROJECTS: IN THE CASE OF ADDIS ABABA CONSTRUCTION OFFICE PROJECTS

By

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A THESIS IS SUBMITTED TO COLLEGE OF ARCHITECTURE AND CIVIL ENGINEERING, DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT, ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF ENGINEERING IN CONSTRUCTION TECHNOLOGY AND MANAGEMENT

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DECLARATION

I hereby declare that this thesis entitled “Assement of workers safety practice in public building construction projects:in the case of addis ababa construction office projects“was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted, in whole or in part, for any other degree or processional qualification. Parts of this work have been published in [state previous publication].

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Date:_____

CERTIFICATE

This is to certify that the project prepared by Mr. Wegen Solomon Tesfaye entitled Assement of workers safety practice in public building construction projects:in the case of addis ababa construction office projects and submitted in fulfillment of the requirements for the Degree of Master of Enginering in Civil Engineering (COTM), complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABSTRACT

In recent years in developed country the health & safety of workers has improved but it is not improved in developing country like Ethiopia,specifically Addis Ababa public construction projects hence, the actual number of accident higher in reality than the reported number and much data on health & safety.The construction industry in Addis Ababa is characterized by high incidents rate of accidents .The objective of this research is an assessment of safety practice involving workers in public building project in the case Addis Ababa public building construction projects. Accordingly, survey research design was used to accomplish the objectives of the study.Mainly a five point Likert scale questionnaire was distributed to engineers and professionals who are working in public building construction projects as a contractor and consultants to may help collect the data for knowing the levels of health and safety conditions in public building construction projects activities used SPSS (Statical Package For Social Sience)software,Eview software for Descriptive analysis and analytical tools used to identify the importance and relative significance of the safety factors that were ultimately utilized to develop the proposed safety framework or safety model.The results show that the safety of workers in Addis Ababa public building construction projects are classified as unsafe practice and required high improvement that is due to a major five causes factors of accidents on the response failure to use Personal Protective Equipment's (PPE),Lack of safety training, Unsafe loading arranging and placing, Lack of education,Negligence & carelessness, Inadequate management of work environment, Taking unsafe positions or postures and Lack of experience. Most of construction companies don't have safety training, safety meeting, safety policies, safety officer, medical and first aid facilities and reporting system. Moreover, the roles of government towards safety are almost minimal under implementation of the General Condition Contracts and Occupational Safety & Health rules.

Keywords: Public, Building, Construction Accident, incident, Safety

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ABBRIVATION

FIDIC= Federation International Des Ingenieurs Conseils

GCC=General condition of contract

GDP= Gross Domestic Product

HSE= Health and Safety Executives

HS = Health and Safety

ILO= International Labor organization

MoFED= Ministry of Finance and Economic Development

MoWUD= Ethiopian Standard Conditions of Contract for construction of Civil Work

OSH = Occupational Safety and Health

PPE= Personal Protective Equipment

PPPA=public procurement property agency

UNIDO = United Nations Industry Development Organization

WHO = World Health Organization

OSHA=Occupational safety and health administration

SME=Small and medium enterprise

SPSS=Statical Package For Social Sience

CHAPTER ONE: INTRODUCTION

1. Background

Construction Industry plays a great role on the national scene. Not only does it touch the lives of virtually everyone on a daily basis, it also occupies a fundamental position in the national economy. It is one of the sectors that Provides crucial ingredients for development of an economy. One cannot think of widespread investment in manufacturing, agriculture or service sectors unless the construction results of infrastructure facilities are in place. Thus periods of national prosperity are usually associated with high levels of construction activity. One is the natural result of the other [Clough and G.A. Sears, 1979].

According to [Seifedin.s ,2014], the Safety of a construction is one of an essential components in the processes of construction when it can been preferred as a mitigation measurement before an incidence occurring. However, in all over Ethiopia, millions of daily laborers work in big constructions through unsafe working environment and without supportive and protective equipment. They do not have protective caps, hand gloves, eye glasses, working clothes, shoes and others. They work on high rise buildings standing on old and inclined wooden scaffolds and ladders; they even transport heavy construction materials on them. Moreover, the constructions do not have safety nets, restraint and fall arrest systems. As a result, a dozen of daily laborers get different serious injuries. Many, in fact, lose their lives.

Hence, the purpose of this research is that to assessment of safety practice involving worker in public building project in case of Addis Ababa city construction office projects.

1.2. Statement of the problem

According to the Addis Ababa construction office report during 2016/17 as examined public construction project more than 10 workers were died due to unsafe practice of construction

Consequently, Addis Ababa fire protection Agency has been mentioned the construction disaster that is more than 42 construction professionals were disabled and passed away because of involving unsafe practice during the year of 2015-2016/17.

Besides, in the last five years the kinds of research indicated that Construction industry accidents in Ethiopia have not been well recorded. Nevertheless,it is reported that many people lost their lives on construction sites and many more seriously injured. Not only are construction workers who suffer injuries and death but also people and children who are not employed in the industry.

1.3. Research Questions

To conduct the research the following research questions are listed.

- What are the causes of accident occurred in public building construction project of Addis Ababa?
- What are the factors that affects a safety practice of public building construction project in Addis Ababa?

1.4. Research Objectives

1.4.1. General Objective

The general objective of the research is an assessment of safety practice involving workers in public building project in the case Addis Ababa public building construction projects.

1.4.2. Specific Objectives

The specific objectives of the research are addressed as follows:

- Investigating the causes of accident in public construction project.
- Developing the factors that are affects safety practice of public building construction project workers.
- To develop simple model to evaluate building construction projects.

1.4. Significance of the study

This research is significant in that it may help the workers engaged in the construction industry how they can reduce accidents in building construction projects and making the site safe while they work at construction site. In addition, this study intends to provide some clue to government for control and follow up of the site condition and the development of policies rules and regulations in construction safety in Ethiopia.

Consequently, this study focuses on public building construction projects workers, another study may be conducted for other type of construction, such as private building construction workers and any other infrastructure construction projects that might provide different result since the nature of the project are different from building project and the size of project being used might also influence the findings.

CHAPTER TWO: REVIEW OF LITRATURE

2.1. Construction in General

The Construction Industry can be described as the sum of all economic activities related to civil and building works: their conception, planning, execution, and maintenance. Such works normally comprise capital investment in the form of roads, railways, airports, ports and maritime structures, dams, power generating stations, irrigation schemes, health centers and hospitals, educational institutions, warehouses, factories, offices and residential premises. Construction is widely acknowledged as the most important single constituent in a developing country's investment program. Because of such a high contribution, the construction industry has a major influence on the economic growth of a country. [Tackel and Mahelet,2009].

The present industrial development level of Ethiopia, compared to other developing countries, is low. Industry plays a leading role in the realization of the Agricultural Development Lead Industrialization Strategy of the country. This is because of its economic and technological contribution in supplying inputs such as raw materials, machinery, hand tools, spare parts, components, construction materials as well as in expanding infrastructure and providing materials and technical services for agriculture and other economic sectors. In addition to this, the sector has got a decisive role in the economic development process of the country in strengthening linkages, interdependence and in attaining a balanced regional development [Tackel and Mahelet,2009].

However, in the construction sector, no significant activity is observed other than the limited research activities on construction materials. Generally, the major scientific and technological problems of this sector are low capability, low capacity in designing and supervising large construction projects, less attention to improve and develop indigenous construction technology and the application of labor intensive construction technique, inadequate local production of hand tools with acceptable quality, lack of well-developed design standard codes and non-conducive system of collection and use and dissemination of information. Therefore, at present, engineering and consultancy, and technology transfer and development capabilities that enable the reduction of dependence and promote self-reliance through time are not well established in the industrial sector [Tackel and Mahelet,2009].

In both developed and developing countries, the construction industry is considered to be one of the most significant industries in terms of its impact on health and safety of the working population. Construction industry is both economically and socially important. However, the construction industry is also recognized to be the most hazardous. The results show that there was still a lack of commitment from the government, the insurance company, the labor ministry, the owners, consultants, and also the contractors to improving safety performance on the construction sites. The suggestion is to improve the safety performance on the construction sites. The government should follow up the safety performance by visiting the construction sites. The insurance company should be more active in visiting the construction sites. The owners should be more active towards the safety by controlling, visiting the

process in the construction sites. The contractors have to train the workers and promote the safety culture and follow up the safety performance. The consultants should control all the tools in the construction sites to insure that those tools are safe [Foad M,2011].

The term building construction worker refers to a person engaged in the physical construction of a building. These individuals could be either skilled or unskilled, depending on the nature of work they are expected to perform on the building site. Building construction workers perform a wide range of tasks, although virtually all these tasks require some form of training and experience, some can be performed with little or no skills [Daniel.N,2015].

2.2. Safety in Construction project

The construction industry in developing countries faces many challenges, one of which is safety. Globally, it is estimated that 55,000 fatal accidents occur at construction sites per year or stated otherwise, that one fatal accident occurs every ten minutes [Lopez V,2001]. In Sub-Saharan Africa, the fatality and injury rates in the construction industry are at 21 and 16,012 per 100,000 workers, respectively [CIDB,2010]. The fatality rate for the construction industry in the United States of America (USA) during the year 2008 was 9.6 per 100,000 workers compared to the national (all sectors) fatality rate of 3.6 per 100,000 workers [Lopez V,2001].In Spain, a country which has some of the highest accident rates in the European Union, the fatality rate in the construction industry during the year 2003 was 20.1 per 100,000 workers compared to the national (all sectors) fatality rate of 7.5 per 100,000

workers [Lopez V,2001]. In Asia, the fatality and injury rates are at 21.5 and 16,434 per 100,000 workers, respectively [CIDB,2010] Due to lack of proper recording and notification systems, construction accidents statistics in developing countries could be underestimated. Nonetheless, the above statistics demonstrate that construction safety is a global problem, and that the scale of the problem is bigger in developing countries compared to developed countries [Richard Irumba,2015]

2.2.1. Definitions and terms of Safety

According to [Allan st john,2015], “Safety“a state of protection and a condition not involving risk

An injury is thus a consequence of an incident but not the only possible one.

Hazard means the inherent property or ability of something to cause harm

According to [WHO,2003],occupational safety and health can be defined as a multidisciplinary activity aiming at:

- Protection and promotion of the health of workers by eliminating occupational factors and conditions hazardous to health and safety at work
- Enhancement of physical, mental and social well-being of workers and support for the development and maintenance of their working capacity, as well as professional and social development at work
- Development and promotion of sustainable work environments and workorganizations

According to [ILO ,1999] definition of occupational health is “The promotion and maintenance of the highest degree of physical, mental social well- being of workers in all occupation” and the WHO considers occupational health service to be responsible for the total of worker and, if possible, his or her family. Occupational Health is a diverse science applied by occupational health professional’s engineers, environmental health practitioners, Chemists, toxicologists, doctors, nurses, safety professionals and others who have an interest in the protection of the health of workers in the workplace.

- Building: - means a permanent or temporary construction used for the purpose of dwelling, office, and factory or for any other purpose [EBP ,624/2009].

- Construction: - means the construction of a new building or any other infrastructure or the modification of an existing building or alteration of its use [EBP ,624/2009].

2.2.2. History of Construction Safety

Injuries in construction have been viewed as part of the job since the early construction efforts. The U.S. government realized the need to protect workers in all industries. The government passed the Occupational Safety and Health Act (OSH Act) of 1970 to address the safety needs in the work environment. The OSH (occupational safety and healthy) Act states the purpose of the act is, “to assure safe and healthful working conditions for working men and women; by authorizing enforcement of the

standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health; and for other purposes

The passage of the OSH Act of 1970 brought forth two major contributors to the safety and well-being of employees in America. OSHA is the first agency that will be examined, and is generally the most recognizable in the construction industry. “The Occupational Safety and health).

Ethiopia has ratified 21 (International Labor Standards) (ILO) Conventions. It was understood that its ratification of the Tripartite Consultation International Labor Standards Convention 1976 (No. 144) is in its final stages. The implementation of these Conventions rides to a significant degree on the capacities of the labor inspection services. For example, the discrimination (Employment and Occupation) Convention1958 (No. 111), the Occupational Safety and Health Convention 1981 (No. 155) and the Worst Forms of Child Labor Convention 1999 (No. 182) all depend on the labor inspection services for their enforcement at the enterprise level [ILO,1999].

According to labor proclamation No. 377/2003, the Ministry of Labor and Social Affairs of Ethiopia is the organ charged with the responsibility to inspect labor administration, labor conditions, occupational health and safety.

2.3. Causes of accidents in construction projects

The Department for Work and Pensions in the UK commissioned a research into construction health and safety practices to ascertain the underlying causes of construction fatal accidents in the UK. The underlying causes of construction accidents identified were categorized under social and industry wide influences project and process factors and worker/supervisor/workplace causes. The causes of construction accidents at the macro level were identified to include immature corporate systems, inappropriate enforcement, lack of proper accident data, lack of leadership from 'Government' as a key client and a lack of influence of trades unions in practice on most sites, especially for smaller projects. Mezzo factors were identified as immature project systems and processes, inappropriate procurement and supply chain arrangements, lack of understanding and engagement by some of the design community, lack of proper accident investigation/data and consequently, a lack of organizational learning. Micro factors included a shortage of competent supervisors; a lack of individual competency and understanding of workers and supervisors; the ineffectiveness or lack of training and certification of competence; a lack of ownership, engagement and empowerment of, communication with and responsibility for workers and supervisors. These factors were also exacerbated by poor behavior, cost pressures; poor equipment or misuse of equipment, including personal protective equipment; site hazards; poor employment practices; an itinerant workforce and inadequate management of and provision for vulnerable workers such as younger, older or migrant workers. The study was based on an international consultation with

15 overseas construction industry expert stakeholders; phone/email interviews/consultation with 27 UK senior construction industry expert stakeholders; in-depth face to face interviews with 15 practitioners from the UK construction industry; and phone interviews with 15 workers representing the UK's smaller organizations/sole-traders [Laryea.s 2010].

According to the National Safety Council (NSC) the statistical distribution of accidents experienced in building construction sites is as follows: Hand tools - 8%, transport-6%, machinery-8%, being struck by falling objects-11%, Personal falls-27%, handling of materials-26% and miscellaneous-6%. These statistics give a clue about the sources of accidents on building sites as cited by [Daniel.N,2015].

As cited by [Daniel.N,2015] the causes of accident (Aniekwe ,2007) in his research concluded that the factors leading to accidents on construction sites include:

- Use of faulty tools.
- Noncompliance to standard safety rules and regulations.
- Improperly maintained and inadequate scaffolding.
- Lack of experience.
- Improper handling and storage of flammables.
- Poor handling of tools and equipment.
- Worker fatigue and boredom.
- Improper Supervision.
- Management attitude.
- Workers operating environment.
- Natural causes.

- Inadequate management of work environment.
- Faults in design details and specifications.
- Faulty construction techniques.
- Workers physical condition.
- Lack of Job satisfaction.

[Zaynab et al ,2012] in a research conducted in Yola, the capital city of Adamawa state in Nigeria concluded that the main causes of accidents on construction sites include the following , listed in order of superiority:

- Lack of safety training.
- Poor understanding of the risks associated with the work.
- Influence of unsafe behavior by workmates.
- Over confidence.
- Shortage of equipment.

It should be pointed out that all these researches are broadly based on the construction industry in general be it road construction, bridge construction and others. It is based generally on all civil construction works, this research will focus primarily on the building construction industry in order to fashion out issues associated precisely with this sector.

Accidents are generally common in the construction sector worldwide; these accidents hinder the progress of activities on construction sites. They result in

injuries or even death of the workers and also financial drain on the part of the construction firm.

As cited in [Daniel.N,2015] listed some major factors capable of causing accidents among workers on sites. The factors include:

- Carelessness.
- Effects of alcohol fatigue or shock.
- Negligence.
- Lack of knowledge to handle new materials and techniques.
- Deliberate risk for bonus or speed.
- Lack of education.

[Elufidipe,2009] The opinion that occurrence of accidents is either because of unsafe working conditions or unsafe acts. He further stated that some accidents happen as a result of employers assigning some jobs to employees (workers) who are not trained to handle such particular jobs without supervision. According to him, unsafe acts on sites could be summarized as follows:

- Failure to use safety attire or personal protective equipment's.
- Unsafe loading, arranging and placing.
- Use of improper tools or equipment.

- Taking unsafe positions or postures.
- Hazardous ways of handling equipment's or tools.

The construction industry is known around the world as one of the most hazardous sectors, especially in terms of fatal workplace accidents. In Brazil, the risk of a construction worker suffering a fatal accident decreased from 32.7 deaths per 100,000 workers in 2000 to 18.6 in 2009. The majority of these deaths were due to falls. Despite the reduction, the level of risk is still high when compared to those in the United States, England, and Finland, countries that have adopted safe practices and are references for safety to the world [African Newsletter 2013].

2.3.1. Site health and safety in construction

The main health and safety site requirements in construction relate to tidy sites and decent welfare, falls from height, manual handling, and transport on site. Site operatives are normally required to plan and organize their operations, ensure that they are trained and competent and know the special risks of their trade and raise problems with their site supervisor or safety representative [HSE,2009]. The main personal protective equipment (PPE) in construction (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects him against one or more risks to his health or safety. PPE should be regarded as a 'last resort' when considering control measures. Other methods should be considered and used that will reduce or eliminate risk to injury. However, where PPE is the only

effective means of controlling the risks of injury or ill health, then employers must ensure that PPE is available. PPE should be worn at all construction sites. A typical construction site may require workers to wear a hard hat, coveralls, safety footwear, gloves, eye protection and high visibility vest. These must be provided to all employees [Laryea.s 2010].

2.3.2. Safety Training

According to [C167,1988] Workers shall be adequately and suitably-

(a) Informed of potential safety and health hazards to which they may be exposed at their workplace;

(b) Instructed and trained in the measures available for the prevention and control of, and protection against, those hazards.

A study by [Hassan ,S.A, 2012] concluded that specialty contractors' safety performance was consistently influenced in part by a number of factors. The factors show to improve safety performance include: minimizing worker turnover; implementing employee drug testing and training of workers .As cited in believed that in the safety programs, for each projects of many contractors, it is a requirement that anyone working on site should receive at least eight hours of safety training or for refresher safety training.

In [Hassan ,S.A, 2012] identified the critical factors that influence the attitudes of construction workers towards safe behavior on construction sites. According to the results of their study, training of operative and safety supervisors is

important to safety awareness and improved performance .The importance of safety training to improve the safety performance in the construction industry has been addressed by many researchers. Effective training of construction workers can be one of the best ways in improving site safety performance. Chinese construction industry had received limited education about safety issues ,similarly; in the study by construction workers identified training as a necessary element of safety performance.[Hassouna,M,A ,2005.] In Gaza Strip found that 24% of the respondents were receiving training courses and all of them achieved a good benefit from it, the main course which was received included the first aid courses, causes of accidents, ways to prevent accidents, the safety technique of scaffolding, and using safety tools. It was also found that part of respondents received safety training abroad such as in Saudi Arabia and the United Arab Emirates (UAE) and other part received training courses in the Syndicate of engineering and in the contractor union. For organized safety training courses for managers, engineer, and labors in [Hassouna,M,A ,2005] found 10% (8) of the respondents, from a total of 83 respondents, have training on how to use equipment and how to perform the danger activity safety, but the other respondents 90% (75) did not have any training for their workers, engineers and labors.

2.3.3. Safety Meetings

A study [Hassanein,2007] concluded that lower injury rates were noted on projects that employed safety officer those which conducted job site safety inspections; and those which included safety in coordination meetings

[Hassouna,2005] Believed that regular safety meeting are necessary for communicating safety information to all parties. 36% of the respondents in their study claimed that they had regular safety meeting, and the other indicated that safety issues were discussed and presented at other meetings, such as construction planning meetings. However, 87% of the respondents Survey in China argued that the top management seldom attended the safety meetings.

2.3.4. Safety policies

Safe and healthy working conditions do not happen by chance. Employers need to have a written safety policy for their enterprise setting out the safety and health standards which it is their objective to achieve. The policy should name the senior executive who is responsible for seeing that the standards are achieved, and who has authority to allocate responsibilities to management and supervisors at all levels and to see they are carried out.

The safety policy should deal with the following matters:

- Arrangements for training at all levels. Particular attention needs to be given to key workers such as scaffolds and crane operators whose mistakes can be especially dangerous to other workers;

- safe methods or systems of work for hazardous operations: the workers carrying out these operations should be involved in their preparation;
- The duties and responsibilities of supervisors and key workers;
- Arrangements by which information on safety and health is to be made known;
- Arrangements for setting up safety committees;
- The selection and control of subcontractors [ILO,1999].

2.3.5. Role of the Government towards safety

[Hassouma M,A,2005] Found that all the respondents for their survey agreed that Kuwait government should play an important role in safety management in the construction industry. In Kuwait, every contractor is required to contact the safety department of the Kuwait municipality when starting new projects and submit necessary documents such as building permit, area location. The safety department provides safety information regarding the proposed job or activity, and a safety representative conducts a site visit to ensure safe places for storage, temporary site offices, and services. Safety posters with major instructions are given to the contractor to be hung at the job site, in addition to safety interaction procedures and accident prevention methods for each activity related to the proposed job. The municipality charges a certain fee as insurance for safety and work completion. This amount is returned to the contractor at the

completion date of the project along with a clearance certificate in [Hassouna,M,A ,2005]

The situation in Saudi Arabia seemed worse than in Kuwait because the practice of safety in Saudi Arabia is not regulated by any government agency in [Foad M,2016]. The practice of safety in construction in the USA is regulated by governmental agencies such as the occupational safety and health administration (OSHA), which provides strict rules and regulations to enforce safety and health standards on job sites.

As cited in [Foad M,2016] The Role of Governmental Institutions in Improving Construction Safety Based on the results, (30) 100 % all the respondents agreed that there is no government institution that follow up safety in construction, enlightenment of the construction employs, in applying safety legislation. In Tripoli there is no government follow up to take care about the safety performance in the construction site that is why the number of accidents so much during the last five years, the study of in Nigeria the similar with study of Tripoli city which found out the industry has no legislation governing OHS, on regulatory authority on construction projects. The results in this study it need improve if compare with other study. The results in this study also similar with the results of Saudi Arabia in [Foad M,2016]. The practice of safety in Saudi Arabia is not regulated by any government agency.Construction projects in the USA is regulated by government agencies such as the Occupational safety and Health Administration (OSHA), which provides strict rules and regulations to

enforce safety and health standards on job sites (OSHA, 1999). In Kuwait, every contractor is required to contact the safety Department of the Kuwait municipality when starting new

Generally, in many countries there are laws and regulations governing the conditions of work in the construction industry. These are usually enforced by factory or labor inspectors who are often also able and willing to provide advice on compliance. However, even in the best-regulated countries the numbers of inspectors are too few to provide day-to-day surveillance on site, even where it is their job to do so.

2.3.6. Safety practice involving building workers

According to ILO, occupational hazard is described as “the latent to trigger damage which may comprise materials or equipment, procedures of function or else other aspects of organization” while risk is defined as “the prospect that the damage from a specific hazard is recognized [Alli,B 2011]

According to ILO, the number of people who died through mishaps and illnesses linked to their profession annually is around two million. In addition to that, around 270 million occupational accidents and 160 million occupational diseases are faced by the workers annually[Somivia.J, 2013] The working conditions contrast immensely among countries, economic segments and social factions. In developing countries, where large masses are involved in hazardous activities such as construction, mining and fishing death toll is significantly high. The ILO

projection is really just the glimpse of problem, because the actual numbers of work-related diseases in developing countries are much higher in reality than the reported numbers [Somivia.J, 2013]

[Zeng et al 2008] Discussed the construction site safety in China. They examined the effect of three factors including orders of production and operations, reputation of firms and psychology of labors on the safety during construction. According to [Zeng et al 2008] study the construction in China is classified as unsafe industry. All the construction firms have records of site accidents, which subsequently affects the reputation of firms. The obvious accidents are falling from the high rise buildings during construction. Although there are factors related to the accidents in construction sites, the main factors include „lack of attention from leaders", „reckless action", „poor safety decisions of managers", „non-certified skilled labor" and „lack of emergency measure".

According to [Ashraf J,2013] most of the factors which influence the health and safety of the workers during construction are the role of HR (human resources) office and the OSH (occupational safety and health) office in the construction company, the personal attitudes of the workers about their health and safety and the role of the administration of the construction company.

Every worker is under a moral, and often also a legal, duty to take the maximum care for his or her own safety and that of fellow workers. There are various ways of involving workers directly in site conditions, such as:

"Toolbox briefing", a five- to ten-minute session with the supervisor just prior to starting a task gives the workers and the supervisor a chance to talk about Safety problems likely to be encountered and potential solutions to those problems. This activity is simple to implement and it may prevent a serious accident [Lucy et al ,2016]

"Safety check"; a check by workers that the environment is safe before starting an operation may allow them to take remedial action to correct an unsafe situation that could later endanger them or another worker [Lucy et al ,2016] Workers should be more directly involved in planning and implementing safe and decent work Safety practitioners and observers have widely agreed that the traditional belief that Employers are solely responsible for workers 'safety at work should change. To create safe working conditions, workers should be allowed to participate actively in OSH and cooperate with employers. Since they are closer to their work, it is felt that the workers themselves are the most qualified to make decisions about safety and job improvements. Evidence shows that various benefits could be yielded if workers worked together with employers, including the reduction of death and injury rates at work. However, to make workers' participation in this effective, several criteria are crucial: legal support, management support, trade union support, training, and the positive quality of the workers involved [African newsletter ,2013] Educating workers and managers in proper procedures and hazards can have a direct impact on jobsite safety. The realization of the large costs involved in construction injuries and

illnesses provides a considerable motivation for awareness and education. Regular safety inspections and safety meetings have become standard practices on most job sites.

Pre-qualification of contractors and sub-contractors with regard to safety is another important avenue for safety improvement. If contractors are only invited to bid or enter negotiations if they have an acceptable record of safety (as well as quality performance), then a direct incentive is provided to insure adequate safety on the part of contractors.

During the construction process itself, the most important safety related measures are to insure vigilance and cooperation on the part of managers, inspectors and workers. Vigilance involves considering the risks of different working practices. In also involves maintaining temporary physical safeguards such as barricades, braces, guy lines, railings, toe boards and the like. Sets of standard practices are also important, such as:

- requiring hard hats on site.
- requiring eye protection on site.
- requiring hearing protection near loud equipment.
- insuring safety shoes for workers.
- providing first-aid supplies and trained personnel on site

While eliminating accidents and work related illnesses is a worthwhile goal, it will never be attained. Construction has a number of characteristics making it inherently hazardous. Large forces are Construction management text involved in many operations. The jobsite is continually changing as construction proceeds. Workers do not have fixed worksites and must move around a structure under construction. The tenure of a worker on a site is short, so the worker's familiarity and the employer-employee relationship are less settled than in manufacturing settings. Despite these peculiarities and as a result of exactly these special problems, improving worksite safety is a very important project management concern.[C.Hendrickson,2003]

2.3.7 The site layout plan and building safety

According to [F. Lawrence Bennett,2003] the jobsite layout plan includes the following: jobsite space allocation, jobsite access, material handling, worker transportation, temporary facilities, jobsite security and signage and barricades. Helpful references for establishing the plan include the construction documents, the program, technical data on lifting and conveyance equipment, local codes, safety standards, size and weights of the large anticipated lifting loads and information from subcontractors and their storage needs. A helpful basis for the site layout drawing will be the project's site plan.[F. Lawrence Bennett,2003]

2.3.7.1. Organizing the worksite

According to [F. Lawrence Bennett,2003]an important activity as the contractor begins work in the field is to set up the site in a manner that will allow the work

to proceed efficiently and effectively. Every job is unique, so guidelines for efficiency and effectiveness are difficult to spell out in general terms. However, a brief discussion of the various elements of worksite organization will be useful. A well-organized jobsite can have a positive influence on the productivity of the entire project, from the delivery of materials to the handling of these materials as they are installed and from the manner in which workers move about the site to their personal needs and safety

2.3.7.2 Temporary services and facilities

The following are among the various temporary services and facilities that will likely be needed offices the jobsite office ‘ranges from a clipboard in a pickup truck to multi-storey office facilities, depending on the scope of the project in [F. Lawrence Bennett ,2003]. The office must be lockable and secure, have adequate desk space and areas for accessing drawings and other contract documents, provide wall space to display the project program, have meeting and storage space and, if possible, offer a direct view of the worksite. Types of jobsite office facilities include existing buildings, modular office units, trailers and site-built offices. The contractor may be responsible for providing office space for design professional and owner representatives or subcontractors; even if not, locations for such quarters must be provided in the site layout plan.[F. Lawrence Bennett,2003]

2.3.7.3 Workshops and indoor storage

On a construction project of even modest size, it is likely that some on-site fabrication will be required and often such work is performed at inside locations protected from the weather. Examples include the preparation of concrete formwork and the pre-assembly of piping systems. Also, repairs of equipment and machinery may require such protected locations. In addition, indoor storage will be needed for various kinds of tools and for materials requiring weather protection that have been delivered and are awaiting incorporation into the project. Like the project office, various types of facilities can be used, including mobile structures and site-built buildings. Two considerations are of prime importance:

(1) They must be located conveniently to the facility being constructed and close to delivery locations in the case of material storage and

(2) They must be secure from theft and pilferage [F. Lawrence Bennett ,2003]

2.3.7.4 Dry shacks

These temporary facilities provide places for workers to store and eat their lunches and to change their clothes. They need not be elaborate, but they ought to be located conveniently to the work and be clean, adequately lit and relatively comfortable.[F. Lawrence Bennett 2003]

2.3.7.5 Temporary housing and food service

The ‘construction camp’ is an important feature of many projects in remote locations. When a project is located such that it is unreasonable for workers to return home every night, sleeping quarters and food service will be provided. Collective bargaining contracts may specify the nature and size of such accommodations. Possible facilities range from modular units and site built buildings for projects of long duration to harbor-docked ships. In some cases, the contractor may simply provide a location for workers to park their trailers or recreation vehicles, which then allow them to sleep overnight and fix their own meals [F. Lawrence Bennett,2003]

2.3.7.6 Temporary utilities

The office and shops will need the usual kinds of utilities, such as electric power, water and communication. In addition, power is likely to be needed throughout the building site and water will be needed from time to time. Until permanent utilities are available, some sort of temporary arrangements will be required. In the case of both power and water, it is important that the onsite source be as central as possible, that the lines do not interfere with the work in progress or delivery activities, that underground lines are not broken during excavation work and that the installations comply with code requirements [F.Lawrence Bennett 2003,]

2.3.7.7 Sanitary facilities

Drinking water, washing water and toilets must be provided for employees, including those of subcontractors. Drinking water is usually provided at the work location, often in 25 liter insulated containers, along with paper cups. Until permanent toilet facilities are available, wash water near temporary toilets is needed. To avoid excessive travel time, toilets should be placed adjacent to the work area. Thus, it is common to scatter these temporary portable chemical units at several locations. One health regulation requires that toilets be located within 200 feet, horizontally, of all workers and that they be available on every third floor of multi-story structures. In addition to the sanitary needs of workers, the contractor must provide for the collection and disposal of construction waste. The importance of recycling requires that provisions be made for sorting various kinds of waste, such as timber, metal, plastics and drywall and accumulating them in separate bins [F.Lawrence Bennett 2003]

2.3.7.9. Medical and first aid facilities

If the project is sufficiently large, the contractor may need to provide a separate building, staffed with medical personnel, to care for the injuries and other health issues that are likely to arise. Or a portion of the project office may be set aside for such purpose. In any case, the facility must be adequately stocked with proper supplies and equipment, be located close to the work activity and be clearly identified [F. Lawrence Bennett 2003]

2.3.7.10. Access and delivery

Like any other community, the worksite must be planned so that it has adequate access to it and within it for the movement of people and the delivery and handling of materials. Access matters therefore are closely related to the planning of temporary facilities and storage and laydown areas. Access roads to the site must be planned so that they give direct access to storage areas, installation areas and entries to worksites. Especially in busy urban areas, such planning also must consider the effect on existing traffic patterns, with the potential for developing undesirable waiting lines of delivery vehicles and disruptions due to oversize trucks and loading equipment. All roadways, both to and on the site, must be built sufficiently to withstand expected loads and sizes of vehicles, they must be planned so that relocating them will not be necessary as the project proceeds and they must have adequate provision for dust control. Parking areas located near access roads but also close to the work will be required. In planning the locations of access roadways and other features, the contractor must also consider site drainage and water control, to prevent disruption to the work and possible environmental damage. Note that a drainage permit may be required, as indicated early in this

Delivery of materials to the jobsite is an activity that lasts throughout most of the project. An effective delivery plan will therefore be an important part of the overall management scheme.

Among the considerations are the following.

- The route from main roads and streets to the jobsite must be clearly marked and adequate to handle the delivery vehicles.

- A smooth traffic pattern for delivery vehicles will allow ease of both access and egress.

- Material should be delivered as close to its installation location as possible. Thus, access to these locations will be important. An example is the delivery of pallets of roofing materials directly to the roof from the delivery vehicle.

- In congested areas, special arrangements may be needed to close streets or to make deliveries at night.

- If the contractor is responsible for unloading materials, provision of proper unloading equipment and personnel will be required according to [F.Lawrence Bennett ,2003]

2.3.7.11 Storage/laydown areas

The systematic storage of materials ensures savings in time when it is time to install the materials. These storage areas are frequently referred to as laydown areas on the jobsite. An area should be established for the delivery of each major material. Sorting of materials as they are delivered will reduce confusion later. The construction program will be a helpful tool to determine when and in what quantities the various materials will need to be stored. Sufficient space must be provided not only for the materials themselves but also for handling

equipment to man oeuvre in aisles or roadways. We have already indicated the possible need for inside storage in buildings, but outside storage also will often require weather protection from heat or cold, wind, rain or snow. Most materials will be set on pallets or skids to keep them off the ground and will be wrapped in tarps or other coverings. Drainage is another consideration for open-air storage. As always, the needs of subcontractors must be considered as plans for laydown areas are develop [F. Lawrence Bennett,2003]

2.3.8. Safety related clauses in general condition of contract for workers

Federation International Des Ingenieurs Conseils (FIDIC) and the Ethiopian Standard MoWUD (Ministry of works and urban development Ethiopia) Conditions of Contract for construction of Civil Work Projects are essential part of construction contract, in Ethiopia defining the responsibilities of the parties involved in the contract and describe the guidelines that will be used for contract administration. In [FIDIC] and[PPPA(Public Procurement Property Agency ,2011] are usually applied to internationally awarded and big projects as the contractors demand it. Locally, the Ethiopian [MOUWD 1994] and PPPA ,2011 Standard Condition a condition of contract is employed There usually preferred. There are some differences between clauses of the conditions. FIDIC and The Ethiopian Standard Condition of contract for construction of Civil work projects are more or less the same as the latter is derived from FIDIC of previous versions. However, there are some differences between the conditions because of refinement of FIDIC from time to time. This thesis focuses on projects constructed by local contractors that usually include MOUWD 1994 and PPPA 2011. In this conditions of contract there are clauses related to safety responsibility of safety among clauses provided to minimize Accidents.,

-Contract; MDB-FIDIC 2006 (Multilateral Development Bank Harmonised Edition)

The protection of workers on site is the primary obligation of the contractor. The contractor should take necessary steps to insure safety of his workers and employer's personnel on site.

Clause 4.1 of the MDB FIDIC in its clause 4.1 indicates the responsibility of keeping the adequacy, stability and safety of all site operations and all methods of construction lies on the contractor. This implies that should insure the safety and wellbeing of its worker at site during the site operation phases.

Clause 4.8, safety procedure, puts the contractor to comply with applicable safety regulation & to take care for the safety of all persons entitled to be on the site, clear any obstructions to avoid danger & to provide necessary fencing, lighting, guarding and watching of the works until taking over by the employer.

Clause 4.18 indicates the contractor should limit damage & nuisance to people. This includes the workers also.

Clause 4.22 the contractor should secure the site against unauthorized persons to protect contractor's & employer's personnel from any danger.

Clause 6.4 the contractor should obey labor laws relating to employment, health, safety, welfare and emigration, and shall allow them all their legal rights.

Clause 6.7, health & safety, the contractor shall take any necessary precautions to maintain the health and safety of contractor's personnel. He shall also insure medical staff, first aid facilities; sick bay and ambulance services are available at all times in collaboration with local health authorities at any accommodation to contractor's & employer's personnel. Under this clause the contractor should appoint an accident prevention officer who is responsible for maintaining safety & protection against accidents. In the same clause the contractor should also conduct HIV-AIDS prevention programs and should aware, provide condoms, provide STI & HIV/AIDS screening, diagnosis, counseling, referral national STD,STI and HIV/AIDS program to contractor's employees, subcontractors, consultant's employees, all truck drivers & crew making deliveries & the immediate local communities.

The contractor is also responsible to supplies of food staffs at reasonable cost, clause 6.13 provide water, clause 6.14, & to protect contractor's personnel employed on site from insect and pest nuisance, clause 6.15.

Clause 7.1, manner of execution, the contractor should execute his work as per the contract or proper workman like & careful manner or properly equipped facilities & non-hazardous materials.

The employer is responsible with regards to workers safety, if safety issue is related to design, any force of nature, riot not by contractor's personnel and others not related to contractor's site operations occurred as per clause 17.3

The contractor should insure against liability for claims, damages, losses and expenses which include legal fees and expenses arising from injury, sickness, disease or death of any person employed by him or any other his personnel as per clause 18.4. This insurance does not include losses and claims arising from the employer or employer's personnel act or neglect. The insurance should be maintained throughout the contract period. The sub contractor's employees insurance may be affected by the sub-contractor but the contractor is responsible to comply with the provisions of this clause.

- Contract; PPPA ,2011

The safety of all site operations is the primary responsibility of the contractor for the adequacy, stability and safety of all operations and methods of construction under the Contract so, workers safety is deemed to be contractor's responsibility according to clause 34.2.

Claus 40.2 the Contractor shall take out insurance covering his liability with regard to industrial accidents and civil liabilities to any person employed by him on the works, to the Public Body and any employee of that authority, arising from the execution of the works. Such liability shall be unlimited in the case of personal injuries. And also be solely liable and shall indemnify the Public Body and the Engineer against any claims for damage to property or personal injuries arising from the execution of the works by the Contractor, his sub-contractors and employees in connection with the Works according to Clause 40.

Claus 45.6 also the Contractor shall nominate a Health and Safety Representative to liaise with the Engineer on all Health and Safety matters, While carrying out the Works, the Contractor shall comply, and shall ensure that its employees comply with, the requirements of relevant Health and Safety and other relevant legislation .

2.4. Worldwide experiences of Safety practice in construction

Many south Asian countries are deficient in appropriate documentation, legislation and surveillance related to occupational health and safety (OHS). All these countries have high OHS incidence rate and laborers working in these countries are constantly exposed to occupational accidents and diseases. Although occupational accidents and work-related concerns have been in debate for a long time, no concrete moves have been taken, making situations worse and posing consistent coercions to an increasing labor force. The current research was carried out to examine the main hazards faced by construction workers in Pakistan and the response of health, safety and environment (HSE) department in reducing these hazards and in curtaining sustainability in construction companies in

As cited by [Shane G,2008]"The construction industry has been classified as one of the most hazardous industries in the United States for many years in terms of both fatal and nonfatal injuries" [Gillen et al 2004] This is a major concern, as the construction industry employs roughly 6% of the workforce in the U.S., but a

disproportionate number of injuries and fatalities occur in construction. “Of approximately 600,000 construction companies, 90% employ fewer than 20 workers”, and of these small companies few have safety programs that are implemented. This could help to explain why a company’s size is usually related to the company injury rate. From 1988 – 1993 the larger construction firms had a lower injury frequency, and as the firm size got smaller the injury rate increased [Mcvittie et al 1997]

Pakistan. Workers working in the construction industry are incessantly bared to unsafe working conditions and have to confront several kind of hazards. This embraces exposure to sound, dust and toxic substances, issues of ergonomics, stress etc. This study employed a comprehensive fact-finding design. Data was harbored using interviews, academic articles and reports from international and national organizations. Employer, administration and laborers all lack knowledge about OHS issues in Pakistan. The majority of the laborers are unskilled, uninformed and unregistered. There are no native directives, which are coupled with both OHS and the construction industry. There is an absence of safety ethics, and neither reporting nor monitoring is conducted in the construction business. Companies see HSE issues as an economic burden which will eventually end up mounting production costs. Laborers don’t follow safety instructions; they don’t wear personal protective equipment (PPE), they reckon wearing this equipment would cause obstruction in their work and would influence their productivity. The use of PPE is essential in the construction

activity, as it is considered as the last line of defense. All this has affected the construction industry tremendously collectively in terms of financial loss, human loss and image loss, and injury incidence rates have increased alarmingly. Implementation of sustainable development is a core responsibility of an HSE department. Dearth of HSE means lack of sustainability in the construction sector. Today, sustainability is an important aspect of development. It means that development should not only be economically feasible but also socially and environmentally viable both for current and future generations. There is much need to formulate new strict policy and laws or to amend old ones, laws which are effective and practical in promoting HSE and sustainability norms in the construction sector of

Pakistan. The main hazards that are faced by construction workers are falling from height, lifting activity and electrocution. HSE departments play a chief role in minimizing worksite accidents and in promoting sustainable development in work settings. For ensuring sustainable practices on construction sites, HSE departments formulate integrated working policy, keeping in mind social, environmental and economic aspects and considering inputs from all stakeholders. In addition, they look for innovative green technologies and green materials which are more environmental friendly, economical and require less energy [Hassan.s,2012]

Construction processes in Nigeria are characterized by unsafe practices leading to accident that leaves severe consequences on both the project and the

workers. Accidents in building construction sites,whether minor or fatal could result to injuries, loss of resources, partial or permanent disability and death in case of fatalities. The paper explores the class of workers that are mainly responsible for construction accidents, the factors that causes accidents and the types of accidents that is been encountered in building construction sites and the frequency of their occurrence. It was achieved through the review of existing [Daniel.N,2015]

According to [Seifedin s,2014] the findings indicate that the overall safety and health condition in the Ethiopian construction industry is very poor. In addition there is very low level of implementation of OSH standards, rule and policies in the construction companies. Little training and orientation on OSH is given to employees, most of the construction companies do not have OSH components like written safety policy, safety officer, health and safety committee, hazard identification and reporting program, and properly placed safety signs. Based on the responses obtained from engineers/foremen, poor working conditions and environment, and lack of personal protective equipment are the main causes of accidents in the construction sector. On the other hand, foot and hand injuries, and falling from heights are the more frequently occurring types of accidents in the industry.

2.5. Mitigation Measurements on Public Building Construction Project

According to [C-167, 1988] PREVENTIVE AND PROTECTIVE MEASURES, Article 13

Safeties of workplaces are considered the following points:

- All appropriate precautions shall be taken to ensure that all workplaces are safe and without risk of injury to the safety and health of workers.
- Safe means of access to and egress from all workplaces shall be provided and maintained, and indicated where appropriate.
- All appropriate precautions shall be taken to protect persons present at or in the vicinity of a construction site from all risks which may arise from such site.

According to [Richard and John ,2009] In order to maintain a safe environment on the job site, the following critical element must be established:

- Review the drawings for potential safety concerns.
- Upper management must be totally committed to safety.
- Learn to communicate safety to all workers on the job site.
- Provide a safety manager and/or director on the job site
- Make sure that the site is clean with no debris scattered around.
- The safety manager and PM must constantly walk the job site.

- Enforce OSHA standards.
- Have weekly toolbox meetings with all trade foremen.
- Review any current problems.
- Request ways to improve safety on the job site.
- The meeting should be of short duration but cover critical issues.
- Make sure all trades are using safety equipment prescribed by OSHA.
- Listen to all the workers and make safety modifications as suggested.
- Have special safety meetings with all “new” workers. (Approximately 25% of the accidents occur with workers working less than one month on the job site.)
- Review all building codes to make sure all safety requirements are being met.
- Listen to weather reports to make sure all equipment and material will be secured
- in case of high winds.
- Make sure that certain trades do not work during inclement weather (i.e., iron workers).

- Have strong language in the subcontractor's contract regarding safety issues. This should include the use of hard hats, safety harness, safety nets, attending safety meetings, etc. Disciplinary action for subcontractor trades people who do not conform to the safety standards must be established for the location for installing nets and a photograph of the nets installed.

- A safety plan has to be prepared which would include location of first aid stations,

- Evacuation plan in case of an emergency, communications set up, and safety horns.

- Install safety signs around the site.

- Prepare a safety manual that will be handed out to all subcontractors.

- Invite insurance safety groups to visit the site and make recommendations.

- Do not rush jobs and overwork the trades' people.

- Drugs and alcohol must be prohibited from the job site.

- Smoking must be prohibited from the job site to eliminate potential fire

CHAPTER THREE:DESCRTIPTION OF THE STUDY AREA, MATERIALS, AND METHODS

3.1. Description of the case study area

The study area, Addis Ababa is the capital city of Ethiopia that is located at 8°7'' northern latitude and 38°45'' eastern longitude with an average altitude of 2400 above mean sea level. At year 2016 the total population of the city is estimated 3.6 million with annual growth rate of 3.8%.The city has divide in 10 sub-cities. The city economy is growing annually by 14%. The city alone currently contributes approximately 50% towards the national Gross Domestic Product GDP, highlighting its strategic role within the overall economic development of the country.

Figure 3.1: Locational Map of Addis Ababa

The consulting company and counterpart for Design & supervision of Construction Works (Addis Ababa construction bureau), is established in 1996

E.C. Named Infrastructure development office and then amended as Addis Ababa housing and construction bureau and current re-organized as under umbrella of construction ministry its named Addis Ababa construction bureau. The bureau is located in Arada sub city near 6 kilo in Addis Ababa city administration. The bureau for building works sector has one head office bureau and 10 sub city bureau at different sub city of the city. The bureau currently renders the consultancy service of: design, construction supervision and Contract Administration of about 237 active major public building construction works (different Warada and sub city administrative, schools ,Hospitals ,health centers, workshops and showrooms for SME (small and medium enterprise) and office buildings for different public agencies in Addis Ababa . However, the construction bureau is still using the traditional unsafe way of constructing a public building. The Addis Ababa construction bureau a public institution in the city that is responsible for the design, supervise and administrating the contract for public building projects.

Besides, the Bureau controls construction industry as a whole and coordinate & consult public participation works like cobble stone under the city and the Bureau is ongoing to established the construction material testing and quality assurance service center. Local contractor who under takes the agreement for construction works of public building projects in Addis Ababa of the study.

3.2. Materials

The study has used the data sources to produce the following basic documents: respondents' documents and archival documents. The respondents' documents were collected using questionnaires from consultants (project owner's representatives) and contractors. This questionnaire survey has closed-ended questionnaires. Archival documents were from ongoing and completed projects, in which contract documents, project construction work progress reports (records), minutes of meeting; site book, site diaries, and accident report document were investigated thoroughly which were very important in identifying the current problems related to safety practice in public building construction projects in Addis Ababa. In addition, they helped to assess how problems on practice of workers safety in public building construction projects in Addis Ababa happen and how they are prevented.

3.3. Methods

The research method is structured in theoretical exploring of relevant topics for an assessment of safety practice involving workers in public building project, practical participation of the stakeholders through questionnaires, case studies and observations.

Design questionnaires and distribute to those who take part in the industry, Detailed questionnaires were designed and distributed for an assessment of safety practice involving workers in public building project in Addis Ababa. In order to have same ground for evaluation, the questionnaires are designed to be uniform to all of the respondents from the perspective of consultant and contractors

This research has highlighted the most touchy issues in relation to workers safety from the perspectives of consultant and contractor through considering the major factors that are globally accepted: the causes of accident, Chance of Occurrence on Site health and safety in public building project, Importanacy of physical site layout plan and workers safety practice and implementation of Safety clauses standard condition of contracts (PPPA) related to worker safety and health of workers

Conduct case study for two completed and two ongoing public building construction projects in Addis Ababa for which the design, construction supervision and contract administration was undertaken by Addis Ababa

construction bureau and the analysis of questionnaires carried out based on the perception of the participants

To Assess existing practice of safety practice involving workers in public building project is evaluated from case studies through particulars of each projects with taking place of health and safety officer ,medical and first aid facility in the site, Warning sign or safety rules in the site ,firefighting equipment,the site have copy of safety and health regulation or policies, physical site lay out plan, Proper lay down area plan ,Regular site safety meeting in the site,the workers fill the working environment is safe, PPE (personal protective equipment) like Safety cloths, helmets, safety boots, hand gloves, hearing protection.As it is this approach was recognized recently, when a strong move towards qualitative approach did open a way to focus on case studies for knowledge contribution rather than general law making principles.

Research can be categorized as applied, exploratory, descriptive and co-relational type. To conduct this study the applied and exploratory research is selected because this research is initiated from a well-defined practical problem from the long time involvement of public building construction projects and since descriptive and co-relational research approach were considered it may tried to describe the nature, cause, and effect of safety and health of building workers documentation, preparation presentation, submittals, substantiations, analysis, cause of accident in public building construction projects in Addis Ababa.

To devise a rational framework for workers safety management necessities, the establishment of the importance of safety factors is essential. A questionnaire survey with a 5-point Likert scale was chosen over other methods, such as Analytic Hierarchy Process was adopted to develop the workers safety performance

The answers for the structured part of the questionnaire are based on Likert's-scale of five ordinal measures of agreement towards each statement (from 0 to 4) were adopted in the following sections. The reasons for adopting this simple scale are:

- To make simple for the respondent to respond, and
- To facilitate analysis of collected data.

Likert's-scale is important to know respondents' feelings or attitudes about something. The respondents must indicate how closely their feelings match with the question or statement on a rating scale.

After expressing their agreement and/or disagreement on the assessment of safety practice involving workers in public building project Addis Ababa respondents are asked about the chances of occurrences of these variables based on the following choices.

Not at all 0 = 0% probability to happen

1-Unlikely = 0% - 25%

2-Likely = 26% - 50%

3-Almost certain = 51% - 99%

4-Certain = 100% probability to happen

After identifying the chances of occurrence of the safety variables in public building construction projects the respondents were asked about four categories in public building construction projects in Addis Ababa of based on the above choices and the questionnaire was carefully designed in light of getting trustworthy and fully-fledged response from respondents and the Statistical Package for the Social Sciences (SPSS) version 20 and Eview version 10 was used for descriptive analysis to perform and the analytical tools used to identify the importance and relative significance of the safety factors that were ultimately utilized to develop the proposed safety framework or Model.

CHAPTER FOUR: ANALYSIS, RESULTS AND DISCUSSION

4.1. Data Analysis and Results

To conduct the research objectives the qualitative and quantitative methods were adopted and the closed ended and case study assessment questionnaires were developed and distributed for respondent on behalf of contractor and consultants chief Engineers who have achieved an excellency of as a position of Resident Engineer, Safety Engineer, site Engineer, Supervisory, Inspector, Contractor, Contract Administrator, Claim Engineer, Architect, Quantity Surveyor, and others the related.

Accordingly, detailed questionnaires were designed for assessment of workers safety practice in public building project in the case of Addis Ababa construction office projects. The major and minor factors are arranged as a cause of leading accident, the chances of occurrence on site health and safety in public building project, the chances of occurrence on physical site layout plan and workers safety practice and the safety clauses implementation related to workers.

In view of that, for the assessment, questionnaires were distributed to the major parties that they have play dominant role in day to day construction activities. Those are contractors, consultants and construction professionals. For the preparation of comprehensive thesis analysis on worker safety, a total of 50 questionnaires were designed and distributed out of which 40 are collected from respondents

General speaking, Almost equal percent of the staffs who responded to the questionnaire were contractor organization and consultant organization workers out of the 40 respondents, 21 (52.5%) respondents were consultant side , 19 (47.5%) were contractor works in public building, and Majority of the staffs who responded to the questionnaire were Site Engineers or supervisor Out of the 40 respondents, 37.5% respondents were Site Engineers, 25%were resident engineer 22.5% were Project managers and 15 % were others like safety engineer and Urban planner made up the others list.

Besides,7.5% of the workers has executed in the last five years less than 2 project, 27.5 % complete 3-5 projects ,17.5% of respondent complete 6-8 projects and 47.5% of the respondent complete greater than 9 projects. This result shows that a majority of respondent have good experience on implementing building construction projects.

The 15% of the workers involved in highest contract value have less than 10 million birr experience in building, 32.5% involved in between 10-50 million birr, 17.5% of the workers involved 50-100 million birr experience and 15% are involved in greater than 100 million birr of experience. In view of that a respondent of workers on building construction done multi story and big size projects.

The 27.5% of the workers have 0-5 years' experience in building, 40% have 5-10 years' experience, 27.5% have 10-15 years' experience and 5% have 15-20

years' experience. Accordingly, a majority of workers on building construction have good experience as about 40% of the sample size had just 5-10 years working experience. See table 4.1.

Table 4.1: Numbers and rate of responses by major stockholder

No	Participants	Distributed in Number	Returned in Number	Response Rate %
1	Consultants(Addis Ababa construction office)	25	21	84%
2	Contractors	25	19	76%
	Total	50	40	80%

The data is reliable a good representative as many collected from offices that are highly involved in public of the sample projects are taken from building construction projects such as city and sub city projects known and experienced contractors. Distribution is done mainly through personal networking for construction professionals. As shown in Table 4.1, the number of consultant or A.A construction bureau engineers in the survey is greater than any other contractors. This is important because the consultant is involved directly in the controlling the site situations and this thesis investigates assessment of workers safety practice in public building project which is the cumulative sum of un safe activity during construction.

Key workers safety practice in public building project in this research, Four major factors are hypothesized towards identifying key assessment of workers safety practice in public building project in A.A. which are Identification of Causes, Chance of Occurrence on Site health and safety in public building project, Chance of Occurrence on physical site layout plan and workers safety practice, Safety clauses implementation related to workers

Therefore the research finding is identifies to assessment of workers safety practice in public building project accordingly from the labels as follows.

4.1.1. Causes of Safety workers practice public building projects

4.1.1.1. Identification of Causes of leading accident

The most frequent causes of accident were assessed using the major factors as it's mentioned on table 4.2 in this sub contents.

In respect to the respondents that is analyzed using SPSS software for descriptive statics and the results are addressed in form of tabular in Table 4.2. According to the mean scores (MS) value of consultants, contractors and construction professionals the 27 identified causes of leading accident are ranked with respect to occurrence as it's perceived by each party is calculated. Mean scores value which is 0 to1 (0%), 1 to 2 (0.1-25%), 2 to 3 (25.1-50%), 3 to 4 (50.1-100) are considered as probability to happen for the causes of the accident. See table 4.2.

Table 4.2:Ranks of leading causes to accident on public building construction project

	Descriptive Statistics			
No	Causes of accident description	N	Mean score (MS)	Rank Top ten
1	Failure to use safety attire or personal protective equipment's. (PPE)	40	2.975	1
2	Lack of safety training.	40	2.55	2
3	Carelessness.	40	2.5	3
4	Unsafe loading, arranging and placing.	40	2.45	4
5	Lack of education.	40	2.35	5
6	Negligence.	40	2.35	6
7	Inadequate management of work environment.	40	2.25	7
8	Taking unsafe positions or postures.	40	2.225	8
9	Lack of experience.	40	2.175	9
10	Improperly maintained and inadequate scaffolding.	40	2.125	10
11	Over confidence.	40	2.075	
12	Workers Operating environment.	40	2.025	

Contd…

13	Poor handling of tools and equipment.	40	2	
14	Management attitude.	40	1.9	
15	Improper Supervision.	40	1.8	
16	Worker fatigue and boredom.	40	1.775	
17	Noncompliance to standard safety rules and regulations.	40	1.7	
18	Use of faulty or improper tools or equipment.	40	1.675	
19	Faulty construction techniques.	40	1.65	
20	Shortage of equipment.	40	1.65	
21	Lack of Job satisfaction.	40	1.6	
22	Workers physical condition.	40	1.6	
23	Improper handling and storage of flammables.	40	1.475	
24	Faults in design details and specifications.	40	1.35	
25	Deliberate risk for bonus or speed.	40	1.3	
26	Influence of unsafe behavior by workmates.	40	1.175	
27	Natural causes.	40	0.95	
	Valid N (listwise)	40		

As per the result that is mentioned above the table 4.2, the top ten leading causes of accident ranked are Failure to use safety attire or personal protective equipment's. (PPE),Lack of safety training ,Carelessness, Unsafe loading, arranging and placing, Lack of education, Negligence, Inadequate management of work environment, Taking unsafe positions or postures and Lack of experience that is due to their mean score value (MS) which is depending on the number of respondents.

Figure 4.1 Leading causes of acccidents

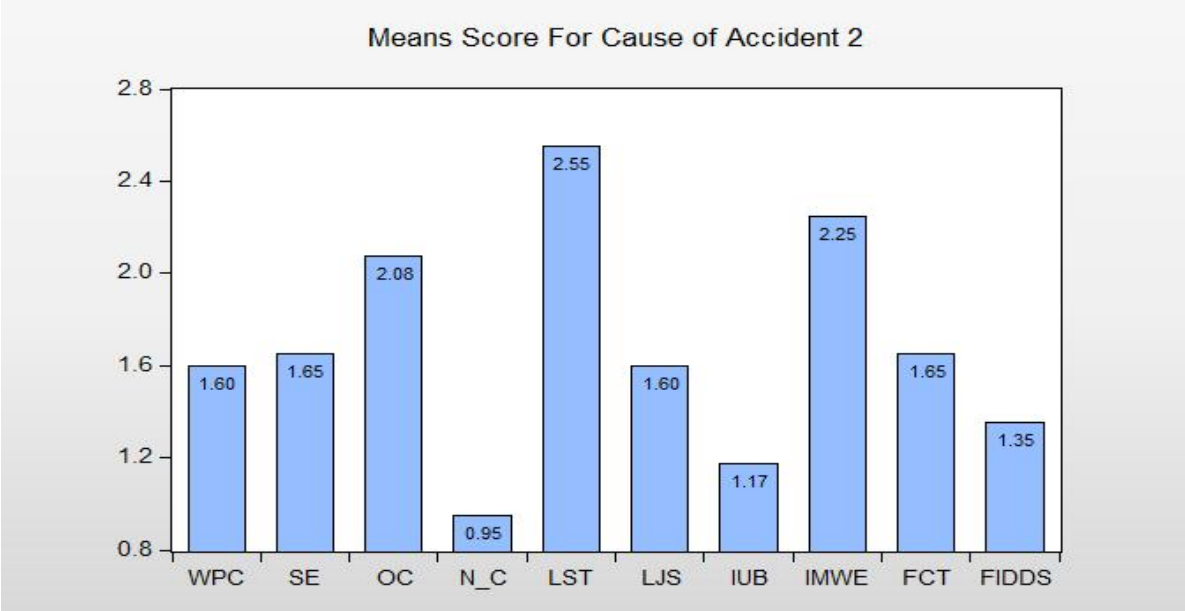

Figure 4.2 Leading causes of acccidents

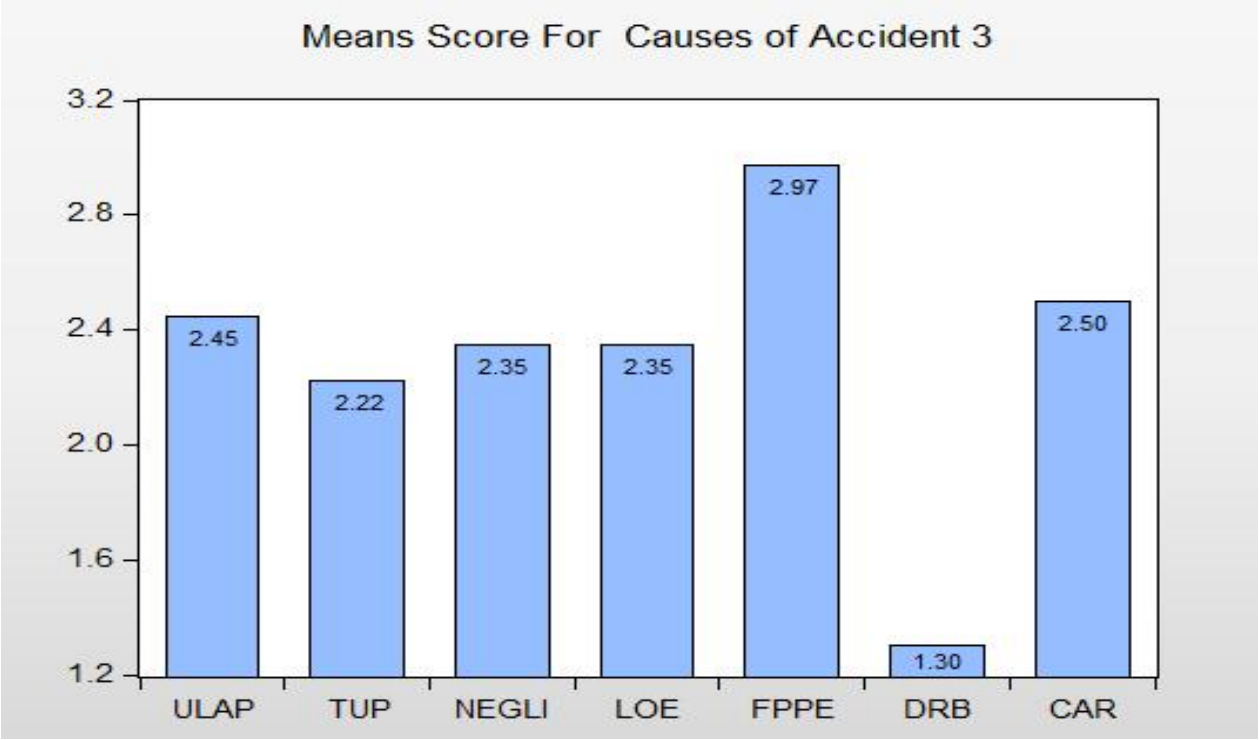

Figure 4.3 Leading causes of acccidents

4.1.1.2. Failure to use safety attire or personal protective equipment's. (PPE)

From the result shown below in the table it is possible to say that the cause of accident is failure to use safety attire or personal protective equipment's is the first cause of accident related to worker safety in public building construction projects in Addis Ababa among 27 listed probable causes by ranking a mean score of 2.975. The results are summarized in the table 4.3 below:

Table 4.3 Failure to use safety attire or personal protective equipment's(PPE).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unlikely	4	10.0	10.0	10.0
	Likely	10	25.0	25.0	35.0
	Almost certain	9	22.5	22.5	57.5
	Certain	17	42.5	42.5	100.0
	Total	40	100.0	100.0	

4.1.1.3. Lack of safety training

From the result shown below in the table it is possible to say that the cause of accident is lack of safety training is second cause of accident related to worker safety in public building construction projects in Addis Ababa among 27 listed probable causes by ranking a mean score of 2.55. The result are summarized in the table 4.4 below:

Table 4.4 Lack of safety training .

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	2.5	2.5	2.5
	Unlikely	9	22.5	22.5	25.0
	Likely	11	27.5	27.5	52.5
	Almost certain	5	12.5	12.5	65.0
	Certain	14	35.0	35.0	100.0
	Total	40	100.0	100.0	

4.1.1.4. Carelessness and negligence

From the result shown below in the table it is possible to say that the carelessness and negligence is the third cause of accident related to worker safety in public building construction projects in Addis Ababa among 27 listed

probable causes by ranking a mean score of 2.5. The result are summarized. 4.5 Below:

Table 4.5 Carelessness and negligence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unlikely	8	20.0	20.0	20.0
	Likely	10	25.0	25.0	45.0
	Almost certain	16	40.0	40.0	85.0
	Certain	6	15.0	15.0	100.0
	Total	40	100.0	100.0	

4.1.1.5. Unsafe loading, arranging and placing

From the result shown below in the table it is possible to say that unsafe loading, arranging and placing is the 4^{th} cause of accident related to worker safety in public building construction projects in Addis Ababa among 27 listed probable causes by ranking a mean score 2.45. The results are summarized in the table 4.6 below:

Table 4.6 Unsafe loading, arranging and placing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unlikely	6	15.0	15.0	15.0
	Likely	17	42.5	42.5	57.5
	Almost certain	10	25.0	25.0	82.5
	Certain	7	17.5	17.5	100.0
	Total	40	100.0	100.0	

4.1.1.6. Lack of education

From the result shown below in the table it is possible to say that the lack of education is 5th cause of accident related to worker safety in public building construction projects in Addis Ababa Addis Ababa among 27 listed probable causes by ranking a mean score 2.35. The results are summarized in the table 4.7 below:

Table 4.7 Lack of education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unlikely	6	15.0	15.0	15.0
	Likely	17	42.5	42.5	57.5
	Almost certain	14	35.0	35.0	92.5
	Certain	3	7.5	7.5	100.0
	Total	40	100.0	100.0	

4.1.2. Chance of Occurrence on Site health and safety in public building project

In order to assess the chance of Occurrence in view of Site health and safety in public building projects in Addis Ababa four major factors which are safety training, safety meeting, safety policy and governments roles were developed and analyzed using SPSS and Eviews software according to the respondents 50 questioners were distributed and 40 were filled, collected back and analyzed of the total respondent 80% of the respondent through questionnaires. The general analysis and its result are listed below.(SAT=Safety training, SM=Safety meeting, SP=safety polices, GR= Government's role,WIN= workers involvement)

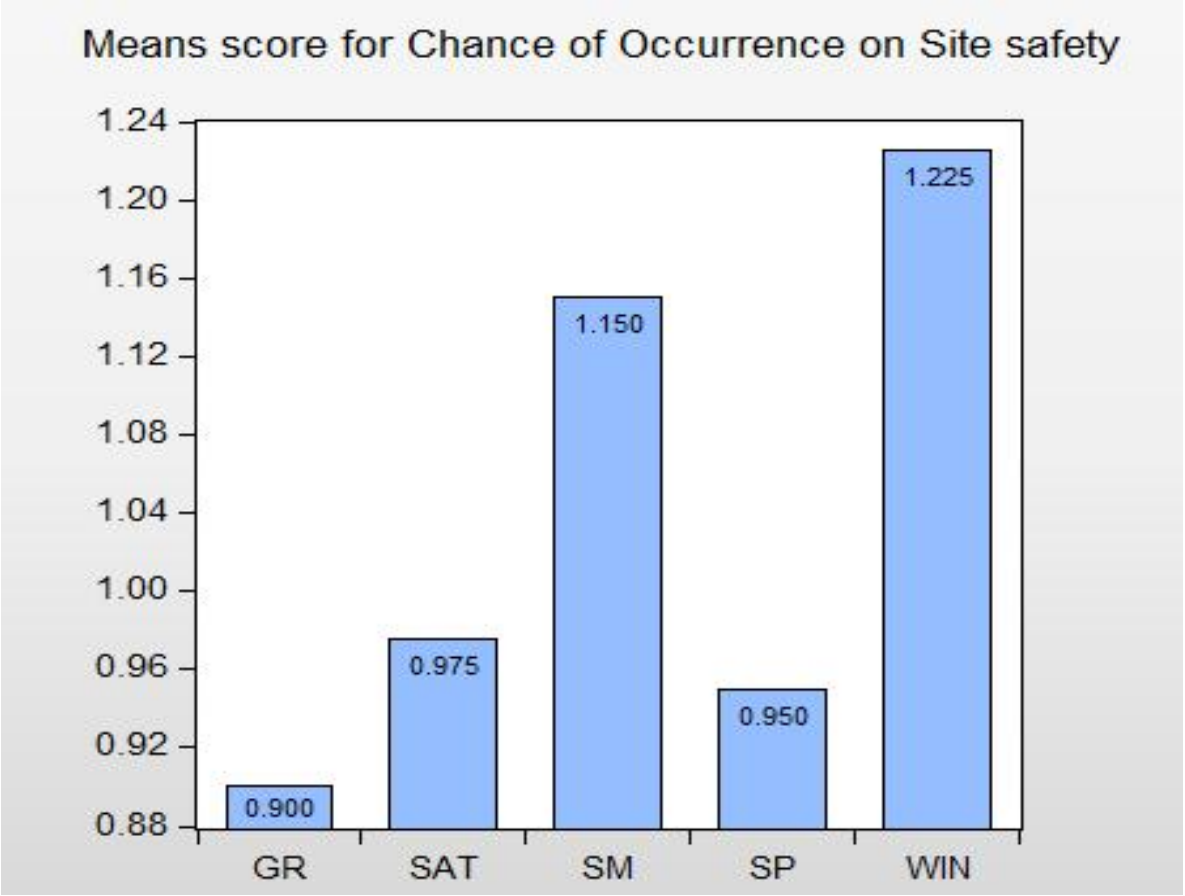

Figure 4.4 chances of occurance on site safety and healthy

4.1.2.1. Safety training to improve the safety performance

In order to assess chance of Occurrence on Site health and safety in public building project with taking safety training to improve the safety performance for public building construction projects in Addis Ababa Site health and safety in public building project .From the result shownbelow in the table it is possible to say that there is no or little training given by contractor or other responsible person to the workers because 80% of the respondent agree by no safety training at all in the site to improve the safety performance related to worker safety in public building construction projects in Addis Ababa.

Table 4.8 Safety training to improve the safety performance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	13	32.5	32.5	32.5
	Unlikely	19	47.5	47.5	80.0
	Likely	4	10.0	10.0	90.0
	Almost certain	4	10.0	10.0	100.0
	Total	40	100.0	100.0	

4.1.2.2. Safety meeting in public building projects

In order to assess chance of Occurrence on Site health and safety in public building project with taking safety meeting to improve the safety performance for public building construction projects in Addis Ababa Site health and safety in public building project From the result shown below in the table the probability of occurrence of safety meeting is almost only 37.5% with taking safety meeting to improve the safety performance related to worker safety in public building construction projects in Addis Ababa. The result are summarized in the table 4.9 below:

Table 4.9 Chance of safety meeting

		Frequency	Percent	Valid Percent	Cumulative
Valid	Not at all	9	22.5	22.5	22.5
	Unlikely	16	40.0	40.0	62.5
	Likely	15	37.5	37.5	100.0
	Total	40	100.0	100.0	

4.1.2.3. Contractor written safety polices

From the result shown below in the table 4.10 it is possible to say that 77.5 % of had no written safety policy in their company to improve the safety performance related to worker safety in public building construction projects in Addis Ababa.

Table 4.10:written safety polices and implementation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	17	42.5	42.5	42.5
	Unlikely	14	35.0	35.0	77.5
	Likely	5	12.5	12.5	90.0
	Almost certain	2	5.0	5.0	95.0
	Certain	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

4.1.2.4. Government's role in improving safety

From the result shown below in the table 4.11 it is possible to say 80% of the respondents believed there is no governmental role to improve the safety performance related to worker safety in public building construction projects in Addis Ababa.

Table 4.11 Government's role towards organizations follow up and contribute

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	17	42.5	42.5	42.5
	Unlikely	15	37.5	37.5	80.0
	Likely	3	7.5	7.5	87.5
	Almost certain	5	12.5	12.5	100.0
	Total	40	100.0	100.0	

4.1.2.5. Workers involvement

From the result shown below it is possible to say no workers involvement in their plan and implementation of safety program because 67.5% the respondents believed there is no workers involvement to improve the safety performance related to worker safety in public building construction projects in Addis Ababa. The result are summarized in the table 4.12 below.

Table 4.12 Chance of workers involvement to implemented the practice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	10	25.0	25.0	25.0
	Unlikely	17	42.5	42.5	67.5
	Likely	8	20.0	20.0	87.5
	Almost certain	4	10.0	10.0	97.5
	Certain	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

4.1.3. Chance of Occurrence on physical site layout plan and workers safety practice

For assessing the chance of Occurrence in respect to the physical site layout plan and workers safety practice in public building projects in Addis Ababa five major factors which are workshop and indoor storage, temporally housing dry shake food service, utilities facilities, medical and first aid and storage and laydown areas were developed and analyzed using SPSS.

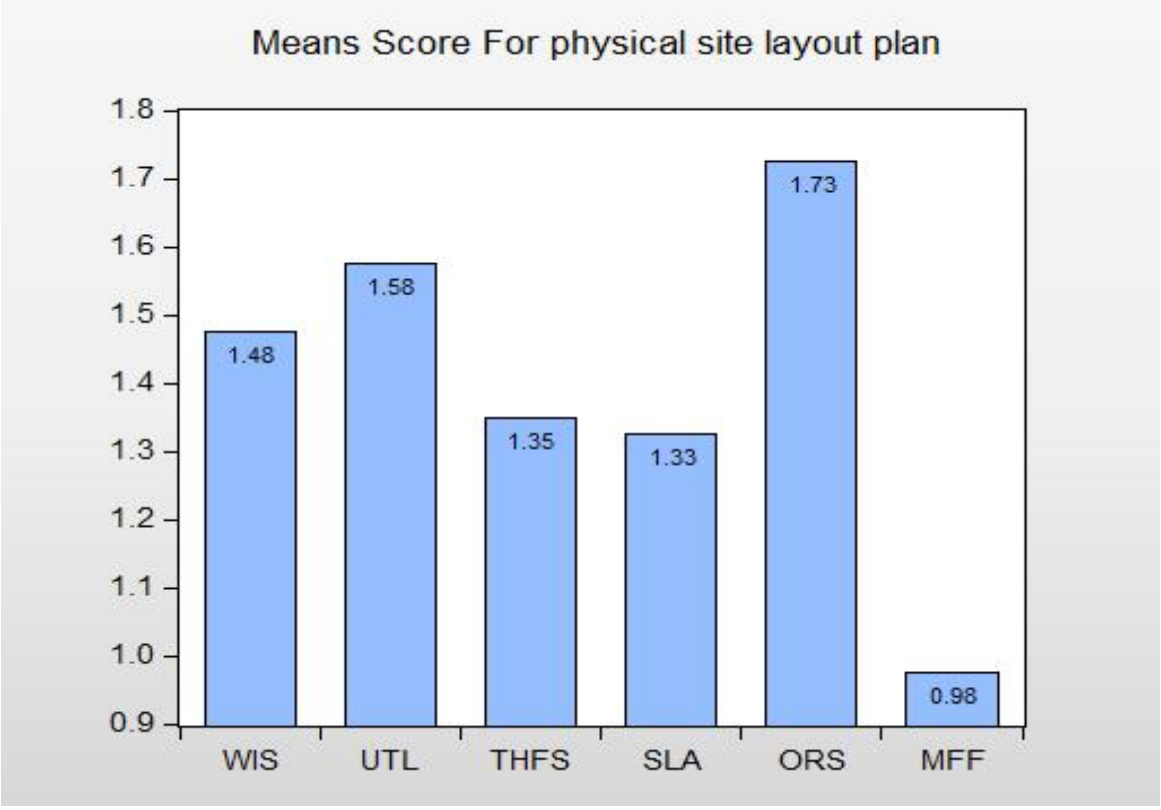

Figure 4.5 chances of occurance on physical site lay out plan

4.1.3.1. Organizing to work site

In order to assess chance of Occurrence on physical site layout plan and workers safety practice in public building project with taking organizing to work site to improve the safety performance for public building construction projects in Addis Ababa Site health and safety in public building project workers;50 questioners were distributed and 40 were filled, collected back, and analyzed, of the total respondent 80% of the respondent responded 5% not at all, 30 % unlikely to be the occurrence, 52.5% replied likely to be occurrence and 12.5% were almost certain that related with taking organizing to work site in the occurrence of Site health and safety in public building project related to worker safety in public building construction projects in Addis Ababa.

From the result shown below in the table 4.13, 65% the respondent agreed that their site are preparing plan to organizing the work site to improve the safety performance related to worker safety in public building construction projects in Addis Ababa.

Table 4.13 Organizing to work site

		Frequency	Percent	Valid Percent	Cumulative perc
Valid	Not at all	2	5.0	5.0	5.0
	Unlikely	12	30.0	30.0	35.0
	Likely	21	52.5	52.5	87.5
	Almost certain	5	12.5	12.5	100.0
	Total	40	100.0	100.0	

4.1.3.2. Workshop and indoor storage

From the result shown below in the table 4.14, 50% the respondent agreed that prepared workshop and indoor storage to improve the safety performance related to worker safety in public building construction projects in Addis Ababa. The results are summarized in the table below 4.14

Table 4.14 Workshop and indoor storage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Almost certain	4	10.0	10.0	10.0
	Likely	16	40.0	40.0	50.0
	Unlikely	15	37.5	37.5	87.5
	Not at all	5	12.5	12.5	100.0
	Total	40	100.0	100.0	

4.1.3.3. Temporally housing and dry shake food service

Table 4.15 illustrates that above 50% the respondent agreed that the contractor prepared temporally housing and dry shake food service to improve the safety performance related to worker safety in public building construction projects in Addis Ababa.

Table 4.15 Temporally housing and dry shake food service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Almost certain	3	7.5	7.5	7.5
	Likely	17	42.5	42.5	50.0
	Unlikely	11	27.5	27.5	77.5
	Not at all	9	22.5	22.5	100.0
	Total	40	100.0	100.0	

4.1.3.4. Utilities facilities including sanitary, electrical, access road, and communication

From the result shown below in the table 4.16 it is possible to say the contractor prepare utilities facilities including sanitary, electrical, access road and communication to improve the safety performance related to worker safety in public building construction projects in Addis Ababa because 62.5% of the respondent agreed by thus.

Table 4.16 Utilities facilities including sanitary, electrical, access road, and communication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Almost certain	3	7.5	7.5	7.5
	Likely	22	55.0	55.0	62.5
	Unlikely	10	25.0	25.0	87.5
	Not at all	5	12.5	12.5	100.0
	Total	40	100.0	100.0	

4.1.3.5. Medical and first aid facilities

From the result shown below in the table 4.17 it is possible to say that 75% the respondent agreed that there is no medical and first aid facilities to improve the safety performance related to worker safety in public building construction projects in Addis Ababa.

Table 4.17 Medical and first aid facilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Certain	2	5.0	5.0	5.0
	Almost certain	2	5.0	5.0	10.0
	Likely	6	15.0	15.0	25.0
	Unlikely	13	32.5	32.5	57.5
	Not at all	17	42.5	42.5	100.0
	Total	40	100.0	100.0	

4.1.3.6. Storage and/or laydown areas

From the result shown below it is possible to say 47.5% the physical site has no planed laydown and/or laydown areas to improve the safety performance related to worker safety in public building construction projects in Addis Ababa. The results are summarized in the table below.

Table 4.18 Storage and/or laydown areas

		Frequency	Percent	Valid Percent	Cumulative
Valid	Almost certain	5	12.5	12.5	12.5
	Likely	16	40.0	40.0	52.5
	Unlikely	6	15.0	15.0	67.5
	Not at all	13	32.5	32.5	100.0
	Total	40	100.0	100.0	

4.1.4. The importance of the Standard Condition [PPA 2011 Clause 34.2, 40.2 and 45.6. for workers safety]

In order to assess the importance of the standard condition of contracts for all public construction projects that are mentioned on PPA November, 2011 Clause 34.2, 40.2, and 45.6 for workers safety in public building project. Hence,for analysis using SPSS software.

The primary clauses dealing with workers safety in use are PPPA November 2011 GCC clause 34.2 This states that the safety of all site operations is the primary responsibility of the contractor for the adequacy, stability and safety of all operations and methods of construction under the Contract so, workers safety is deemed to be contractor's responsibility according to clause 34.2 and the second clauses dealing with workers 40.2 states that about insurance covering his liability with regard to industrial accidents and civil liabilities and the last one that is clauses 45.6 about safety nominate a Health and Safety Representative.

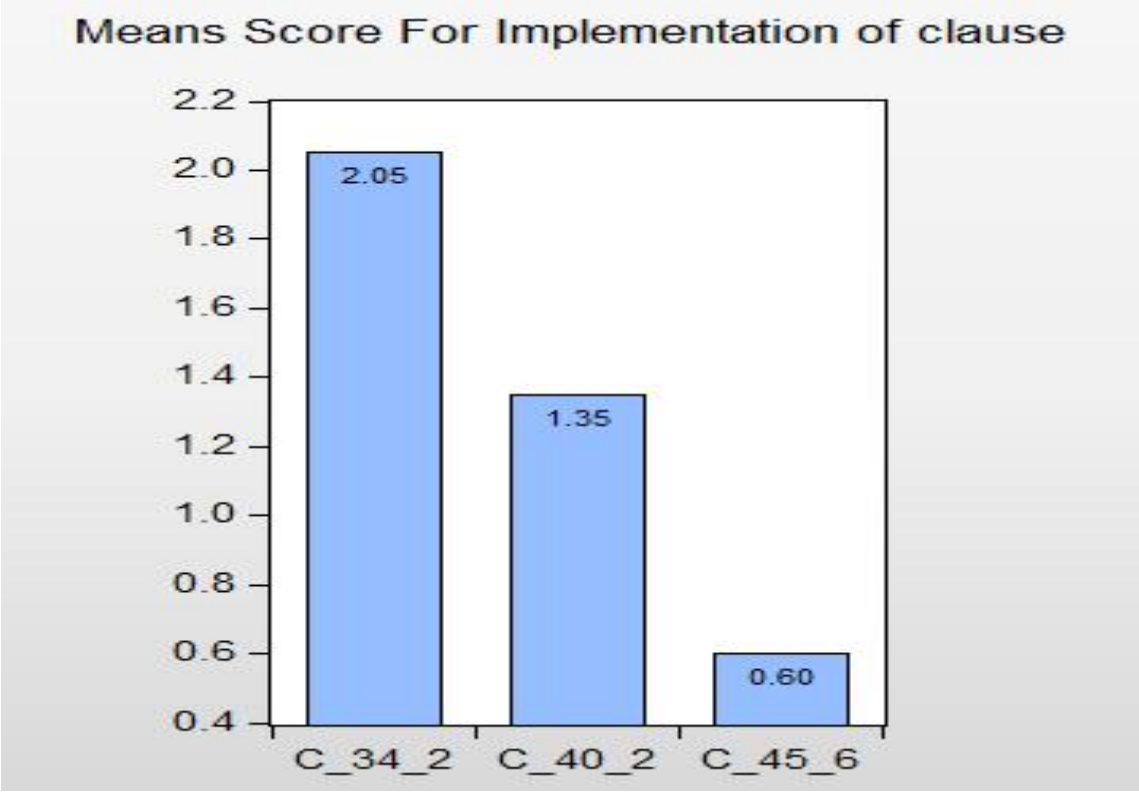

Figure 4.6 Implimantation of PPPA cluseas related to workers

From this,the analysis Standard Condition of Contacts for all public construction projects, PPA November, 2011 Clause 34.2 for workers safety is very important and implemented by contractor in public building construction projects in Addis Ababa as shown below in the table.

Table 4.19 Implementation of clause 34.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	2	5.0	5.0	5.0
	Unlikely	11	27.5	27.5	32.5
	Likely	15	37.5	37.5	70.0
	Almost certain	7	17.5	17.5	87.5
	Certain	5	12.5	12.5	100.0
	Total	40	100.0	100.0	

In view of this, to see the Standard Condition of Contacts for all public construction projects ,PPA November, 2011 Clause 40.2 for safety of workers in public projects According to the result of the question 55 % of respondent agreed clause 40.2 not implemented by contractor to public building construction project owners in Addis

From this,Clause 40.2 related to is very important but not implemented by contractor in public building construction projects in Addis Ababa. The result is summarized in the table 4.20 below

Table 4.20 Implementation of clause 40.2

		Frequency	Percent	Valid Percent	Cumulative Perce
Valid	Not at all	10	25.0	25.0	25.0
	Unlikely	12	30.0	30.0	55.0
	Likely	14	35.0	35.0	90.0
	Almost certain	2	5.0	5.0	95.0
	Certain	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

From this, from the analysis Standard Condition of Contacts for all public construction projects,PPPA November 2011 Clause 45.6 for workers safety is very important but completely not implemented in public building construction projects in Addis Ababa because 90% of respondent agreed clause 45.6 not implemented by contractor to public building construction project in Addis Ababa . The result is summarized in the table 4.21 below:

Table 4.21 Implementation of clause 45.6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	22	55.0	55.0	55.0
	Unlikely	14	35.0	35.0	90.0
	Likely	2	5.0	5.0	95.0
	Almost certain	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

4.2. Assessment of workers safety practice through case studies

A case study of 2 completed and 2 ongoing public building construction projects in Addis Ababa were investigated and analyzed. Detail of each building construction projects were considered; project name, project location, project owner (client), consultant, contractor, Total contract amount ,contract time, project commencement date and physical percentage for each projects.

According to Case study of Project one from the investigation of study this public building construction projects

- Location in Arada sub city near in 4 kilo project Arada sub city
- Client Arada sub city chief executive's office building project ,
- Contractor Afro Tsion construction PLC ,
- Total contract amount 290,081,891.54 birr ,
- Contract time 820 days
- Commencement date 10 Nov 2015 ,
- Physical percentage 85%
- Project have a site record the workers in the selected projects
- Availability of occupational accident death 0 permanent disability 0 temporary disability 38 persons .

- The contractor nominate health and safety officer ,
- The site have medical and first aid facility in the site,
- The site have warning sign or safety rules in the site ,
- The site have firefighting equipment,
- The site also have the site have copy of safety and health regulation or policies
- The contractor prepare physical site lay out plan, Proper lay down area plan ,
- The site also have regular site safety meeting in the site , the workers fill Feeling the working environment is safe, in this site the workers have some PPE (personal protective equipment) like Safety cloths, helmets, safety boots, hand gloves, hearing protection

They have health and safety reporting system, also workers provided with clear directions on manual handling

Case study of Project two: From the investigation of study it this public building construction projects are located in Bole sub city near in Megenagna project Bole sub city Administration office

- Client bole sub city chief executive's office
- Contractor RAMA construction PLC

- Total contract amount 226,991,473.43birr
- Contract time 1563 days
- Commencement date 24 October 2012 ,
- Physical percentage 100% the project have a site record
- Availability of occupational accident death 0 permanent disability 2 temporary disability 432 persons
- The contractor nominate health and safety officer ,
- The site have medical and first aid facility in the site,
- The site have warning sign or safety rules in the site ,
- The site have firefighting equipment,
- The site also have the site have copy of safety and health regulation or policies
- The contractor prepare physical site lay out plan, Proper lay down area plan
- The site don't have Warning sign, physical site lay out plan , safety Proper lay down area plan ,Regular site safety meeting in the site rules in addition to the above workers have all PPE (personal protective equipment) except hearing protection They have health and safety

reporting system;also workers provided with clear directions on manual handling this shows that, this project are good in safety practice

Case study of Project three From the investigation of study this public building construction projects are located in Gulele sub city near in Addisu gebeya

- Project Gulele sub city Adminstration office
- Client Gulele sub city chief executive's office
- Contractor RAMA construction PLC ,
- Total contract amount 202,757,736.22 birr ,
- Contract time 1720 days
- Commencement date 24 oct 2012
- Physical percentage 95%
- the project have a site record
- Availability of occupational accident death 1 permanent disability 2 temporary disability 468 persons
- For this projects contractor nominate health and safety officer in the site ,
- No availability of medical and first aid facility in the site,

- No firefighting equipment,
- They don't have copy of safety and health regulation or policies,
- The workers don't fill Feeling the working environment is safe &
- They don't have Warning sign, physical site lay out plan , Proper lay down area plan ,regular site safety meeting in the site rules
- workers have all PPE (personal protective equipment) except hearing protection like Safety cloths helmets, safety boots &Hand gloves .

Case study of Project four

From the investigation of study this public building construction projects are

- Location -Bole sub city near in Bole Michael
- Client- Bole sub city health office sub city
- Contractor Anacon construction PLC
- Total contract amount 12,810,704.01 birr
- Contract time 365 days
- Commencement date 10 Nov 2015
- Physical percentage 100%
- The project have a site record of the workers in this site accidents in is not been well recorded nevertheless,it is reported that many people suffer

for accident in this sites and there is no implementation of safety with respect of my parameters that is health and safety officer ,medical and first aid facility in the site, Warning sign or safety rules in the site ,firefighting equipment,the site have copy of safety and health regulation or policies, physical site lay out plan, Proper lay down area plan ,Regular site safety meeting in the site,the workers don't fill the working environment is safe, workers doesn't have PPE (personal protective equipment) like Safety cloths, helmets, safety boots, hand gloves, hearing protection

4.3 Workers Site Safety Assesement Frame Work in Public Building Construction Projects.

Accordind to [K. Priyadarshani et al 2013] the analytical tools used to identify the importance and relative significance of the safety factors that were ultimately utilized to develop the proposed safety framework.to develop the model the given analysis and formula weres adopted mainly by using main factors and sub factors safety of workers.

Importance of main factors

The data collected from the questionnaire survey were analyzed according to the Mean Score (MS), as performed by [Ng et al. 2005]:

$$MS = \sum f * \frac{s}{N} \quad (0<MS<4) \quad \text{.....Eq 1}$$

where

f = frequency of responses rating each main factor,

s = score given to each main factor by the respondents and

N = total number of responses concerning that factor.

The MS was then used to determine the Relative Importance (RI) of each main factor by

$RI(M)_j = MS_j \div \sum_{J=1}^{N} MS\ j$.....Eq 2

where

$RI(M)_j$ = relative importance of the j^{th} main factor and

MSj = mean score of the j main factor.

The results reveal that all four main factors are important for construction safety workers safety because the MS are greater than the medians value ‘’2’’ Workers site safety and health management system are the most important main factor.

Importance of sub factors

To establish the importance of each sub factor, MS was computed using the same formula used above, where f = frequency of responses rating each sub factor, s = score given to each sub factor by the respondents and N = total number of responses concerning that factor. Then, the RI of each sub factor was calculated as follows:

$RI(M)_{ij} = MS_{ij} \div \sum_{J=1}^{N} MS\ ij$.....Eq 3

where

$RI(S)_{ij}$ = relative importance of the I^{th} sub factor under the ^{jth} main factor and

MS_{ij}= mean score of the i^{th} sub factor under the ^{jth} main factor.

Table . 4.22 Summary of the Mean Scores of Main Factors

Factors affecting worker of safety	Mean Score	Relative Ranking	Relative index
Workers Site Safety and Healthy Management System	2.96	4	0.2804137
Occurance of Physical Site Lay Out Plan	2.454166667	2	0.2324939
Implimantation Of Clause Provisions	2.666666667	3	0.2526249
Implimenting in the Site	2.475	1	0.2344675

Importance of sub factors

To establish the importance of each sub factor, MS was computed using the same formula used above, where f = frequency of responses rating each sub factor, s = score given to each sub factor by the respondents and N = total number of responses concerning that factor. Then, the RI of each sub factor was calculated

SAFETY MANAGEMENT ASSESSMENT FRAMEWORK

In developing the Safety Management Assessment Framework, a Performance Index (PI) for each sub factor is calculated, as in Ng, Cheng and Skitmore (2005). The RI of each sub factor and its corresponding main factor are combined with the weight score to generate a Performance Index. The PI

represents the score that could be assigned to each factor according to the actual safety performance:

$PI_{ij} = ((PW * RI(S)_{ij} * RI(M)_j))/4 * 100$.....Eq 4

where

PI_{ij} = performance index of the i^{th} sub factor under the j^{th} main factor and PW = weighted score of different safety performance levels with <25= Poor, 25-50 = Satisfactory, 50-75 = Good, 75-100= Very good.

After calculating all of the potential index values for each sub factor under each performance scenario, the Safety Management Assessment Framework was developed according to the RI calculated above .

Based on the above Total Performance Score, benchmarks are established as follows:

1. If the total score (or average score) is < 25, the performance is poor;

2. If the total score (or average score) is between 25and 50, the performance is satisfactory; and

3. If the total score (or average score) is > 50, the performance is good

Furthermore, if the total score (or average score) is equal to 100, the performance is very goo

Table 4.23 Summary of Mean Scores of Sub Factors

Factors affecting worker of safety	Mean Score	Relative Ranking	Relative index
Workers site safety and health management system probability			
How much of your building construction project has been encountered the safety training to improve the safety performance?	3.025	3	0.2043919
What is the chance of safety meeting to happen in your public building projects in Addis Ababa?	2.85	7	0.1925676
Did the contractors have a written safety polices and implemented on their public building construction projects?	3.05	4	0.2060811
Did you see the government's role towards organizations follow up and contribute in improving safety in the public building construction projects?	3.1	2	0.2094595
What is the chance of workers involvement to implemented the practice of safety encountered in public building construction projects?	2.775	8	0.1875
		SUM	1
OCCURANCE OF PHYSICAL SITE LAY OUT PLAN			
How much of your building construction project has been encountered organizing to work site?	2.275	14	0.1544992
Workshop and indoor storage	2.525	12	0.1714771
Temporally housing and dry shake food service	2.65	11	

Contd.....

Utilities facilities including sanitary, electrical, access road, and communication	1.575	18	0.106961
Medical and first aid facilities	3.025	5	0.2054329
Storage and/or laydown areas	2.675	9	0.1816638
		SUM	1
IMPLIMANTATION OF CLAUSE PROVISIONS			
Implementation of PPPA ,GCC clause 34.2	1.95	17	0.24375
Implementation of PPPA GCC clause 40.2	2.65	10	0.33125
Implementation of PPPA GCC clause 45.6	3.4	1	0.425
		SUM	1
IMPLIMENTING IN THE SITE			
Failure to use safety attire or personal protective equipment's. (PPE)	2.975	6	0.3005051
Unsafe loading, arranging and placing.	2.45	13	0.2474747
Taking unsafe positions or postures.	2.225	5	0.2247475
Improperly maintained and inadequate scaffolding.	2.25	16	0.2272727
		SUM	1

Table 4.24 Safety Performance Assement Model for Building Construction Workers

WORKERS SITE SAFETY ASSESEMENT FRAME WORK IN PUBLIC CONSTRUCTION PROJECTS						
Factors affecting worker of safety						
Workers site safety and health management system probability	Poor *1	Satisfactory*2	Good*3	Very Good*4	Score	Total
How much of your building construction project has been encountered the safety training to improve the safety performance?	1.432857	2.86571406	4.29857	5.73142812		
What is the chance of safety meeting	1.349964	2.699928949	4.04989	5.399857898		
The contractors have a written safety polices and implemented on their public building construction projects	1.444699	2.889397647	4.3341	5.778795295		
The government's role towards organizations follow up and contribute in improving safety in the public building construction projects?	1.468382	2.936764822	4.40515	5.873529644		

Contd.....

workers involvement to implemented the practice of safety	1.314439	2.628878187	3.94332	5.257756375	
				Subtotal 1	
OCCURANCE OF PHYSICAL SITE LAY OUT PLAN					
Organizing to work site	0.898003	1.796005368	2.69401	3.592010737	
Workshop and indoor storage	0.996684	1.993368596	2.99005	3.986737191	
Temporally housing and dry shake food service	1.046025	2.092050209	3.13808	4.184100418	
Utilities facilities including sanitary, electrical, access road, and communication	0.621694	1.243388332	1.86508	2.486776664	
Medical and first aid facilities	1.194048	2.38809505	3.58214	4.7761901	
Storage and/or laydown areas	1.055893	2.111786532	3.16768	4.223573064	
				Subtotal 2	

Contd.....

IMPLIMANTATION OF CLAUSE PROVISIONS						
Implementation of PPPA, clause 34.2	1.539433	3.078866346	4.6183	6.157732691		
Implementation of PPPA, clause 40.2	2.09205	4.184100418	6.27615	8.368200837		
Implementation of PPPA, clause 45.6	2.68414	5.368279782	8.05242	10.73655956		
				Sub total 3		
IMPLIMENTING IN THE SITE						
use safety attire or personal protective equipment's. (PPE)	1.761467	3.522933607	5.2844	7.045867214		
safe loading, arranging and placing.	1.45062	2.901239441	4.35186	5.802478882		
Safe positions or postures.	1.3174	2.634799084	3.9522	5.269598168		
properly maintained and adequate scaffolding.	1.332202	2.664403568	3.99661	5.328807137		
				Subtotal 4		
Total Performance score=subtotal 1 +subtotal 2+subtotal 3 +subtotal 4						

4.4 Discussion of case study

From the case study results health and safety officer ,medical and first aid facility in the site, warning sign or safety rules in the site ,firefighting equipment, safety regulation or policies, physical site lay out plan, Proper lay down area plan ,regular site safety meeting in the site are the most significant factors that causes un safe site condition in the site but among four case study projects one which is health center or project 4 totally nothing implemented the parameters from this it is to say that the site is dangerous for workers.

project 3 have safety record and reporting system from this 1 death 2 permanent disability and 468 temporary disability persons record incidents in generally from the given 16 parameters this site implement 7 parameters only from this the site is only 44 % safe to workers and 56 % of this public building projects workers are characterized as unsafe workers .

project 2 have safety record and reporting system from this 0 death 2 permanent disability and 432 temporary disability persons record incidents happen but from the given 16 parameters this site implement 11 parameters only from this the site is only 69 % safe to workers and 31% un safe for workers .

project 1 have safety record and reporting system from this 38 temporary disability persons has recorded incidents happen but from the given 16 parameters this site implement 14 parameters only from this the site is only 88 % safe to workers and only 12% unsafe to workers.

in generally among four case projects one is safe and the other projects are required to implement the safety rules accordingly and the case study project four are totally dangerous work environment site for the worker

4..4.1 Discussion of results of questionnaire

In view of Site health and safety practice in public building project 80% of respondent agreed that due to un availability of training workers in their public building construction project to improve construction safety and 62.5% of the respondent agreed that nothing is there is for safety meeting during the construction of public projects .

Regarding to safety policies the research find out 77.5% depicts that construction firms doesn't have a clear safety written policy due to un awareness of the necessity of safety policies towards improvement of the construction of safety practice.

80% of the respondent is agreed with unavailability of the governmental role for construction workers to keeping their healthy that is happening to unsafe practice public building construction projects.

Accordingly the construction workers required to involve for improving construction safety this study confirm that 67.5 % has been agreed with involvement of construction workers for improvement of construction safety.

Chance of Occurrence on physical site layout plan and workers safety practice

From the analysis showed that physical site lay out plan the average percentage of the participated firms in the Addis Ababa city that concern about using of site lay out plan in construction sites. When ranking the listed five parameters , the result found that the concern in using utilities facilities including sanitary, electrical, access road, and communication came in the first degree with score 62.5% of the respondent agreed on preparing utilities for the workers .The second Storage and/or laydown areas with score 52.5% of the respondent agreed properly planed lay out areas ,Temporally housing and dry shake food service and workshop & indoor storage, are the third by scoring equal 50 % are in the next degree of concern respectively, and then the use of medical and first aid facilities less concern from the previous parameters.

The developed frame work may help the various stakeholders of a construction project to more effectively manage construction safety because those factors may facilitate making key decisions in a project. When safety aspects are well managed, the frequency of accident occurrences can be reduced. Additionally, this research provides effective and efficient guidelines on construction safety for construction organizations, and the framework will be tested by collecting feedback from industry expert in the future .

4.5. Limitation of the study

- It was so difficult to observe all the public construction projects due to the scope of the project the study is dependent on respondent questioner and case study even though the participant were well experienced in construction industry thus sampling might have an impact on the general output of the study.

- Scarce of budget , so it is so important in the further researches to concentrate on the safety practice by site observation from commencement up to completion of the project and cost of safety, culture of workers safety.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1. Conclusions

- As this study revokes that data about records of accidents in Addis Ababa in particular were not readily available, this was basically because Company staffs in Addis Ababa do not report accident cases to the responsible government agencies for adequate documentation.

- Failure to use safety attire or personal protective equipment's. (PPE), Lack of safety training and carelessness are the main reasons contributed to the increase of rate of accidents in the public building construction projects

- This research revealed that virtually all public building construction firms in Addis Ababa are lack safety consciousness in their practice, it further revealed that the workers do not get safety meeting and the contractors doesn't have safety policy,no workers involvement in their safety plan and implementation program

- The governmental body in charge of the construction industry are seriously lacking in carrying out their roles and services.

- Safety of construction sites can be considered as one of the major and a potential dangerous environment that requires regulation by law since powerful machinery, hazardous materials, scaffolding and trenches create

risks for the construction workers, other people in and around the constructing areas.

- Contract documents PPPA 2011 conditions of contract are providing necessary clauses to regulate safety of the workers this document tried to specify obligation of contracting parties in regard to safety of the workers but it has excessive gap in implementation.

- Among the good features, according to the respondent the contractor plan physical site lay out plan like utilities facilities including sanitary, electrical, access road, and communication, storage and/or laydown areas, temporally housing and dry shake food service and workshop & indoor storage .

- The developed Safety Management Framework for construction workers is a more comprehensive framework for evaluating construction safety management.(see table 4.24)

5.2. Recommendations

Based on the findings of this research, the following recommendations will be most useful:

- The government should ensure all construction sites erect safety signs before construction can commence. Pictorial books/brochures presenting different hazardous working conditions should also be provided for the workers, these books should contain just pictures so it would be easily understood by even the illiterate workers.

- The government should follow up the safety performance in the construction sites by visiting the construction site and evaluating the safety performance during the construction project and punish the contractor who make safety violation

- Technical bid evaluation of new projects should look into the past experience of the contractors with respect to construction safety and the consultant must allocate higher percentage for it to award a construction project.

- Site meetings should be encouraged on site, such meetings will enable workers express their grievances, observations and challenges to their employers easily

- Use of personal protective equipment should be made mandatory. Every worker should know how to wear them and what is the purpose of using

them. It has been observed that use of personal protective equipment's (PPE) significantly reduces the danger of occupational hazards punish the workers who make safety violation.

- The contractors should train the workers, promote the safety culture for workers and educate them on how to avoid the risk and use the equipment properly in the construction site.

- The contractors must prepare the regular safety meeting during the work in the construction site.

- The contractor must hire safety officer and prepare safety policy

- From contract and legal point of view, contractors are more liable than the employers. Therefore, recommend contractors to be cautious in reducing occurrence of risks and improving safety of all the environments. If they do so they will become more profitable by reducing insurance costs and they will also reduce any regulatory action arising from safety.

- The developed framework should be used within the industry as an effective management tool for site safety and to overcome threats of hazards before an accident occurs. (see table 4.24)

- The university should better to graduate safety engineer and occupational safety and health education should be given by colleges/universities to

students who will be working in the construction sector when they graduate

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Annex A: Questioner cover page

SCHOOLOF CIVIL ENGINEERING AND CONSTRUCTION TECHNOLOGY

DEPARTEMENT OF CONSTRUCTION TECHNOLOGY AND MANAGMENT

MSc PROGRAM IN CONSTRUCTION TECHNOLOGY AND MANAGEMENT

MSc THESIS (INDEPENDENT PROJECT) ON AN ASSESSMENT OF WORKERS SAFETY PRACTICE IN PUBLIC BUILDING CONSTRUCTION PROJECTS IN ADDIS ABABA

The objective of this research is, through a case study, to assess the existing workers safety practice in public building project: in the case of Addis Ababa construction, with respect to local contractors. What is the existing workers safety practice in public building Construction Projects in Addis Ababa? What is the level of safety practice and accidents occurred involving in public building project in Addis Ababa? What are the factors of safety practice in construction project? With this survey, In the long term this research help the contracting parties and regulatory bodies to make the working environment safe. All information you provide will kept in strict confidentiality and only used for academic research .Please feel free to answer the questions with what you know and what you think in your mind .I value your participation and thank you for the commitment of your golden time, energy and effort.

Sincerely Wegen .s
E-mail-wegensolomon778@gmail.com

Cell- phone-0911019456

Annex B: Questionnaire General Information

Questionnaire to be used to gather the Assessment of safety practice involving workers of Public Building Project in Addis Ababa .This questionnaire two parts

Part I –General information

Part II- Assessment of safety practice involving workers of Public Building Project in A.A

Part I –General information

1. Please write your company's name……
2. Project ……
3. please specify what most represents your organization

   □ Contractor □ consultant □ client □ others
4. Your position

   □ Resident engineer □ Project manager □supervisor engineer □ other
5. Your experience relating to building construction project

   <5 □ 5-10 □ 10-15 □ 15-20 □
6. The highest contract value you ever worked (in birr, million)

   <10 □ 10-50 □ 50-100 □ >100 □
7. Classification of your firm in construction business

   Governmental □ Private □ Other specify_____

8. Number of projects implemented during last five years

□ <2 □ 3-5 □ 6-8 □>9

9. Number of stories in your building project

□ <3 □ 3-6 □ 7-9 □>10

PART II- Assessment of safety practice involving workers of Public Building Project in Addis Ababa

The following table consists description about causes of accident, Chance of Occurrence on Site health and safety in public building, physical site layout plan and workers safety practice ,Safety clauses implementation related to workers of construction projects of at Addis Ababa. Based on your experience please rate your answer by marking X under each preference (0-4).

Note: -

0- Not at all = 0% probability to happen
1- Unlikely = 0% - 25%
2- Likely = 26% - 50%
3- Almost certain = 51% - 99%
4- Certain = 100% probability to happen

Assessment of safety practice involving workers of Public Building Project in Addis Ababa through Quaternaries

Annex C: A) Causes of leading accident

No.	Description	0 (0%)	1 (25%)	2 (50%)	3 (75%)	4 (1000%)
		Not at all	Unlikely	Likely	Almost certain	Certain
1	Please rank the fallowing heading for safety workers practice according to the causes that you encountered in public building projects in Addis					
	• Use of faulty or improper tools or equipment.					
	• Noncompliance to standard safety rules and regulations.					
	• Improperly maintained and inadequate scaffolding.					
	• Lack of experience.					
	• Improper handling and storage of flammables.					
	• Poor handling of tools and equipment.					
	• Worker fatigue and boredom.					
	• Improper Supervision.					
	• Management attitude.					
	• Workers Operating environment.					
	• Natural causes.					
	• Inadequate management of work environment.					
	• Faults in design details and specifications.					
	• Faulty construction techniques.					
	• Workers physical condition.					

Contd.....

	•					
	• Lack of Job satisfaction.					
	• Lack of safety training.					
	• Influence of unsafe behavior by workmates.					
	• Over confidence.					
	• Shortage of equipment.					
	• Carelessness.					
	• Negligence.					
	• Deliberate risk for bonus or speed.					
	• Lack of education.					
	• Failure to use safety attire or personal					
	• Unsafe loading, arranging and placing.					
	• Taking unsafe positions or postures.					

Annex D:Chance of Occurrence on Site health and safety in public building project

No.	Description	0 (0%)	1 (25%)	2 (50%)	3 (75%)	4 (1000%)
		not at all	Unlikely	Likely	Almost certain	Certain
1	How much of your building construction project has been encountered the safety training to improve the safety performance?					
2	What is the chance of safety meeting to happen in your public building projects in Addis Ababa?					
3	Did the contractors have a written safety polices and implemented on their public building construction projects?					
4	Did you see the government's role towards organizations follow up and contribute in improving safety in the public building construction projects?					
5	What is the chance of workers involvement to implemented the practice of safety encountered in public building construction projects?					

Annex E Chance of Occurrence on physical site layout plan and worker safety practice

No.	Description	0 (0%)	1 (25%)	2 (50%)	3 (75%)	4 (100%)
		not at all	Unlikely	Likely	Almost certain	Certain
1	How much of your building construction project has been encountered organizing to work site?					
2	What are the chances of providing temporally service and utility facilities in your public building projects in Addis Ababa from the following?					
	- Workshop and indoor storage					
	- Temporally housing and dry shake food service					
	- Utilities facilities including sanitary, electrical,					
	- Medical and first aid facilities					
	- Storage and/or laydown areas					

Annex F: Safety clauses implementation related to workers

No.	Description	0 (0%) not at all	1 (25%) Unlikely	2 (50%) Likely	3 (75%) Almost certain	4 (100%) Certain
1	How much is the implementation of the Standard Condition of Contacts for your public building construction projects [PPPA November, 2011 Clause 34.2, 40.2 and 45.6 for safety practice of worker]. As per, PPPA November 2011 GCC clause 34.2, 40.2 and 45.6 respectively. - The safety of all site operations is the primary responsibility of the contractor for the adequacy, stability and safety of all operations and methods of construction under the Contract so, workers safety is deemed to be contractor's responsibility according to clause 34.2. - The Contractor shall take out insurance covering his liability with regard to industrial accidents and civil liabilities to any person					

Thank you wegen.s

Annex G: Check list for case study

CASE STUDY PROJECTS

Project:_____

Location:_____

Client:_____

Consultant:_____

Contractor:_____

Total Contract time: _____

Commencement date according to contract: _____

Physical percentage: _____

Observation or filled by respondent	YES	NO
1) Records of all individual workers	☐	☐
2) Availability of occupational accident & incident record	☐	☐

Temporary ☐

Permanent ☐

Death ☐

3) Availability of occupational health and safety bored	☐	☐
4) Availability of health and safety officer	☐	☐

5) Medical and first aid facility in the site ☐ ☐

6) Warning sign or safety rules in the site ☐ ☐

7) Firefighting equipment ☐ ☐

	YES	NO
8) The site have copy of safety and health regulation or policies	☐	☐
9) Physical site lay out plan	☐	☐
10) Proper lay down area	☐	☐
11) Confined work place	☐	☐
12) Regular site safety meeting	☐	☐
13) Feeling the working environment is safe	☐	☐
14) Workers have PPE (personal protective equipment)	☐	☐

- ✓ Safety cloths ☐
- ✓ Helmets, ☐
- ✓ safety boots ☐
- ✓ Hand gloves ☐
- ✓ Hearing protection ☐

15) Health and safety reporting system ☐ ☐

16) workers provided with clear directions on manual handling? ☐ ☐